

COMMON SENSE SCIENCE.

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PREFACE.

THESE little essays, now specially addressed to an American public, are mostly endeavors to place before American readers some of the latest results of modern science, in simple, clear, and intelligible language. Myself born in America, I am glad thus on a return visit to my native land to contribute somewhat to the formation of that great mass of thought which must ultimately quicken and inform the whole world of civilization. Dating as I do from Thoreau's town, I trust I may have caught some slight echo of Thoreau's inspiration.

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COMMON SENSE SCIENCE.

I.

SECOND NATURE.

WE have all said a hundred times over that habit is a second nature — repeating thoughtlessly the acute remark of some nameless and forgotten popular philosopher, some Peckham Socrates or some Bloomsbury Aristotle, who first invented, no doubt, that now historical phrase; but very few of us, in all probability, have ever reflected how profoundly true and brilliantly luminous is the idea wrapped up in that simple and familiar commonplace of the present generation. It is often so with current platitudes; beginning as the wise and witty sayings of some pregnant and pithy local character, they are picked up and repeated carelessly by other people who never even dream themselves of realizing their full meaning or true import, and they pass at last into the position of proverbs, bandied about daily in common conversation, with scarcely a relic of their original savor and fresh cleverness remaining in them. And yet the unknown thinker, whoever he may

have been, who first struck out the lucid conception of habit as a second nature, must have possessed philosophical and psychological powers of no mean order. For he touched at once, as if with the needle-point of fine criticism, the very core and heart of the matter; he summed up in a single short and easy epigrammatic sentence a whole condensed scientific theory of habit and repetition. Habit is that which by use has become natural to us; nature is habit handed down from our ancestors, and ingrained bodily in the very structure of our brains and muscles and nervous systems.

Let us look first at a few of the more extended manifestations of habit, where it assumes hereditarily the very guise and form of nature. It is well known that the children of jugglers, rope-dancers, tumblers, and acrobats can be much more easily trained and taught their fathers' profession than any casual ordinary members of the general public. They are born, in fact, with quicker fingers, more supple limbs, nimbler toes, easier muscles, than the vast mass of their fellow-citizens. The constant practice of hand or foot has made a real difference at last in the very structure and fibres of their bodies; and this difference is transmitted to their children, so that the conjurer, like the poet, is to some extent born, not made. It is just the same with many other arts and handicrafts. Chil-

dren descended from musical families are musical almost from their very birth — those born of parents both of whom have constantly played the harp or the piano exhibit a suppleness and ease of movement in the arms and fingers entirely wanting to the sons and daughters of agricultural laborers or unskilled mechanics. So, too, mountaineers of many generations' standing have limbs specially adapted to mountain climbing — for example, the Indians of the Andes differ immensely in the proportions of their bones, and particularly of their thighs, from all other individuals of the human race; and from babyhood upward this originally acquired difference makes itself evidently seen in the children of such Indians. In these and numberless other like cases we recognize at once that habit has at last produced a positive physical difference in the individuals of the particular profession or tribe concerned, and that the difference so begotten is handed down, as a matter of original nature, to the second generation. Our nature, in short, depends upon the structure with which we are at birth endowed; and this structure itself in turn depends, in part at least, upon the acquired habits and functional practices of our parents and our remoter ancestors.

But habit itself, within a single person's own lifetime, also tends to acquire the fixity and rigidity of nature — becomes in time almost irresistible

and, as it were, automatic. Look, for instance, at the smallest matters connected with the way we dress ourselves, cut up our food, or perform our most ordinary every-day actions. Everybody has a fixed order for putting on his socks; either he puts on the right foot before the left, or *vice versa*, and any attempt to reverse the accustomed order seems to him not only awkward but almost unnatural. So, again, in buttoning his collar, he either buttons the right half over the left, or the left over the right; and, whichever he does, he does it regularly, he doesn't fluctuate casually from morning to morning, doing it now one way and now the other. A very curious difference exists in this respect between men's dress and women's; tailors always put the buttons on the right side and the buttonholes on the left; while dressmakers adopt the contrary course, putting the buttons left and the buttonholes right. Now, if a man, by any accident, has the buttons sewn on any garment the unfamiliar way, he finds himself as awkward as a baby in the attempt to fasten them; while if a woman, on the other hand, puts on a man's coat, she is struck at once by what seems to her the clumsy way the thing has to be fastened wrong-side on. In each case the habit of buttoning on one side has become absolutely automatic; the muscles and nerves of the fingers have adapted themselves to the accustomed move-

ments, and are incapable of performing any alternative motion with equal facility. If any person watches himself for a single day in this manner, he will find there are thousands of similar little actions he performs almost unconsciously, by mere organic routine, each step in the process being followed, without the necessity for thinking, by the next in order, exactly as the words and rhymes of any familiar piece of poetry help to call up one another in memory, without the slightest conscious effort. As the French proverb quaintly puts it, he who says A must say B also.

A very good example of this automatic power of habit is seen in the way we almost all wind up our watches every evening. At a certain fixed stage in the process of going to bed, one hand seeks automatically the waistcoat pocket and pulls the watch out; the other dives without sense of effort into the recesses of the purse in search of the watch-key which is oftenest recognized not by sight but by mere feeling. Then the watch is opened as if by clockwork, the key is turned round automatically a certain familiar number of times, and duly replaced in the proper pocket; the face is shut down again without ever thinking about it; and finally the watch itself is hung up on its peg or laid down upon the table by the bedside, as the case may be, while all the time perhaps we have been steadily reflecting or talking about

something else, and hardly even been aware at all of what it was we were muscularly engaged upon. So purely mechanical is the process, indeed, that people who do not habitually dress for dinner generally find themselves winding up their watches whenever they take off their waistcoats to assume the civilized swallow-tail and white tie of modern society. The action has become stereotyped in the nervous system, and when once the first step of the series is taken by unbuttoning the coat, all the rest follows as a matter of course, without the necessity for deliberation or voluntary effort. Sometimes, indeed, even the will itself is not strong enough to beat such chains of habit; Dr. Hughlings Jackson mentions a curious case where an omnibus horse in the streets of London obstinately refused for several minutes to move on at the combined commands of his driver and a policeman. Shouts and whipping were all in vain; the creature declined to budge an inch to please anybody. At last a passenger inside suggested mildly, "Shut the door, conductor!" The conductor slammed the door with a bang, and, as he did so, rang the bell. That familiar sign was too much for the obdurate horse's nervous system. Within all his experience, when a new passenger got in, and the omnibus was ready to start again, the door was slammed and the bell rung. He could not resist the force of habit. He set off at once at a round

pace, as if acted upon magically by some powerful spell, and forgot at once all about his sulky temper.

Much the same sort of routine practice is apparent in the lives of every one of us. An immense number of little acts and phrases every day are performed and repeated by pure force of habit. We do ten thousand habitual things, as it were, instinctively. "How do you do?" we ask a friend twenty times running, if we meet him again; not because we want to assure ourselves as to the state of his constitution so very frequently, but because the mere act of meeting him calls up the words mechanically to our lips. "Quite well, thank you," we answer thoughtlessly to casual inquiries about the health of our families, even though we may at that very moment be anxiously running to get the doctor on the sudden outbreak of scarlet fever in the bosom of the household. In the same way, when we have once got into the habit of addressing letters to a particular person at a particular place, the mere act of writing his name upon an envelope is followed almost irresistibly by the familiar number of the house and direction of the street in which he lives. We may have been accustomed for twenty years to send all our notes for Jeremiah Tompkins to 37 East Fourteenth Street, New York City; if increasing means and fashionable desires induce our friend to remove to the more select neighborhood

of Fifth Avenue, we still find that, whenever we have got as far with his address as "Jeremiah Tompkins, Esq.," the pen seems of itself to run on into 37 East Fourteenth Street, and it is only with an effort that we substitute in its place the new address in the more dignified up-town district. Everybody has had abundant examples of the same sort within the range of his own experience. We change our banker, let us say; but as soon as we write on an envelope the words, "The Manager," in a trice the name of the old bank writes itself down against our will in the place of the new one. We go away from home on a holiday; but at the head of our letters we still tend to begin by dating from the old familiar domestic address. At the commencement of each new year, how hard we find it to alter from the old date to the new, though the practice has run but for a single twelvemonth; while every married lady must well remember with what difficulty she altered her maiden signature to the one forced upon her by the not wholly distasteful necessities of marriage. After one has written all one's lifetime, up to date, "Very affectionately yours, Ethel Smith," it must be with a sudden pull-up of the pen and hand that one alters it at last by an effort of will into "Ethel Montgomery."

What is the rational and underlying cause of this force of habit? Clearly, the nerves and brain

elements become altered by usage, so that the directive action runs more easily along a certain channel than along any other. Very few acts of our lives are isolated ; most of them move in trains or sequences so associated that one immediately summons up another, each act being, so to speak, the cue or call-word for the next in order. The nervous energy flows most easily along the most accustomed channels ; set up the first step in the sequence, and all the other steps follow regularly, exactly as in repeating any well known and familiar formula. Habit, in short, becomes a second nature because it modifies to some extent our original minute bodily structure, and makes nerves and muscles act together constantly in certain almost indissoluble chains of co-ordinated action. The oftener we do a thing, the easier it thus becomes ; and when we have done certain things one after another, over and over again for many years, the tendency of the first to call up the others in due succession becomes at last all but irresistible.

There is some reason, indeed, to believe that nature itself or personal idiosyncrasy depends ultimately upon mere habit — not, of course, the habit of the individual himself who possesses it, but of his earlier ancestors, paternal and maternal. It is now fairly well proved that the character with which every one of us is endowed at birth must

be regarded as a direct inheritance from our fathers and mothers, our grandfathers and grandmothers, in varying degrees of compounded qualities. Hence, while habit is a second nature, it may also be said that nature in turn is a secondary habit. What we are by nature we largely or even entirely derive from the various acquired habits of our ancestors; what we make ourselves, on the other hand, by habit we largely pass on to the natures of our children and our remoter descendants. And this consideration renders the awful responsibility of the formation of habits even more painfully evident than ever. It is a serious enough thought that every wrong act indulged in, every weakness gratified, every temptation yielded to, helps to stereotype the evil practice itself in the very fibres and tissues of our bodies. But it is more serious still to consider that every habit thus thoughtlessly or wickedly formed is liable to be transmitted to our children after us. Drunkenness, for example, as we all know, tends to show itself as a hereditary vice. Well, then, every act of culpable yielding to the temptation to drink to excess is not only a step to the formation of an ingrained habit in the person himself, but also a step towards the setting up of a hereditary tendency to drunkenness in his children and descendants. On the other hand, the more strongly any such besetting sin assails us by nature — the more

deeply implanted it may be in the very form and structure of our nervous system — the greater is the necessity for constant watchfulness against its insidious attacks, and the deeper the importance of guarding against it by every means that lies in our power. To form a bad habit is of all things most dangerous when we find ourselves already prone to the habit by very nature. By way of compensation, however, we may reflect with pleasure that every temptation resisted, every weakness thwarted, every active exercise of self-control ensured, helps to build up a habit of resistance, and makes victory over the evil more easy in future. Exactly as by frequently writing the new address of the friend who has moved we learn at last to forget the old one, so by frequently and constantly taking the better course of action we learn at last, almost without an effort, to avoid the worse. The right habit becomes, as it were, a second nature; as in the case of the most upright of modern philosophers, about whom Sir Henry Taylor has acutely observed that he hardly seemed to be even conscientious — it appeared as though he acted right under all circumstances quite automatically and without the possibility of doing otherwise. There are people, indeed, descended from exceptionally fine stocks on either side, of whom it has been well said that they are almost born “organically moral”: the impulse to act right seems in their inherited

natures to have completely outweighed the impulse to act wrong; and what many of the rest of us do with a voluntary effort these happily constituted and beautiful characters seem to do, so to speak, mechanically and unconsciously.

II.

MEMORY.

OF all the wonderful miracles of nature, animate and inanimate, there is perhaps none so perfectly and inscrutably marvellous as the human memory. We do not now refer to the specially cultivated and trained memories of exceptional geniuses, the Mezzofantis who can speak two hundred languages, or the Macaulays who can repeat by heart whole pages and volumes of prose or poetry; we are thinking merely of the common average human being, the Tom, Dick, and Harry that we meet at every turn, and whose simple native power of recollection and reminiscence seems to us almost the very greatest marvel in the whole vast museum of the physical universe. For even the humblest and most ordinary memory is stored and stocked in all its innumerable cells and pigeon-holes with such an endless collection of facts and ideas as might well appall the stout heart of the most ardent statistician. Indeed it is probable that most people, for want of analytical habits, immensely underestimate the extraordinary storehouse of their

own memories. We believe the merest child or the most ignorant peasant knows and remembers a number and variety of things which, when all put together, ought easily to surprise the most learned and thoughtful of men. Where the room can be found "in one small brain" to stow away so many facts and fancies is a real puzzle of no small magnitude.

Look first, for example, at the mere wealth and copiousness of language. Every one of us is fully acquainted with his mother-tongue to the extent of at least three or four thousand words, every one of these words answering to an idea, and calling up in his mind the picture of an object or action with which it is associated. Think of the number of visible things alone of which we know and remember the names. Let us take a single small group of objects only—say fruits—and consider of how many such we know the names, and can immediately conjure up a mental picture. To begin with, there are strawberries, raspberries, gooseberries, currants, and all the similar common garden favorites. Then there are blackberries, whortleberries, haws, sloes, and an endless succession of wild kinds. Next, the orchard supplies us with apples, pears, peaches, plums, apricots, nectarines, quinces, and medlars. Once more, there are the imported exotic kinds, oranges and lemons, pine-apples and dates, figs and cocoa-

nuts. And so on through an almost endless catalogue. The bare names of the fruits alone perfectly well known to every reader would probably fill the entire length usually devoted to these essays. For have we not entirely omitted the whole great family of melons and gourds, vegetable marrows and cucumbers, the mulberry and the tomato, the grape and the cherry, and so on in infinite variety? Whatever group of things we begin to think of, we shall find that just the same wealth and variety of common every-day knowledge occurs to us; each of us knows hundreds of animals and birds and fish and insects; each of us is acquainted with the names of so vast a number of diverse objects as would fill a whole volume of close-packed type, or exhaust the resources of a considerable dictionary.

Then again consider the fact that, besides the mere names themselves, we are all acquainted with innumerable points in the appearance or habits of all the objects thus mentally enumerated. Take a single example out of all the number thus quoted—say the first, a strawberry, and reflect for a moment how many facts about its structure or growth the merest child or ignoramus can immediately remember. Almost all of us know, of course, that the strawberry grows upon a low plant or vine, that all its leaves are arranged in sets of three leaflets each, that its flower is white and of

a particular shape and appearance, that the berry is produced from the centre of the blossom, that it begins by being hard, green, and sour, and grows soft, red, sweet, and luscious as it gradually ripens. Most of us can readily recall at once the look and taste of the strawberry, its size and shape, its color without and within, the little green "hull," or "hank," formed by the calyx, and the tiny brown seeds dotted in pits over its whole rosy surface. Here is a vast collection of facts, easily remembered by almost everybody, about a single small English fruit. If we take a bigger object, such as an elephant, the range of memory in the same way is still more marvellous. At once we have conjured up before our mind's eye the picture of that vast, unwieldy animal, of his head and trunk, his huge lopping ears, his mouth and tusks, his big legs and crushing feet, his thick skin, his sleepy eyes, his stumpy tail, his queer gait, his cunning manners. If we try to think of all the facts we know about him otherwise, his native home, the mode in which he is hunted, the importance of his ivory, the objects made from it, his use as a beast of burden, the "castles" or howdahs which he carries on his back, his appearance at the Zoo or in the travelling wild-beast show, and so forth throughout a hundred like particulars, it is fairly astonishing how wide a range of facts every child or fool pos-

sesses about the history and habits of that one great Asiatic and African animal.

Once more, not only do we know the names of so many distinct objects or creatures, and the attributes or qualities at once summoned up in our minds by the names themselves, but we also know and remember endless groups and collocations of words, current phrases, or stock sayings, all of which we can employ in conversation whenever they are needed, with the same ease and certainty as we employ the separate words themselves of which they are compounded. Yet each of these common formulas of speech has had to be unconsciously learnt and remembered quite as truly, though not with so much difficulty, as the multiplication-table or the names and dates of the kings of England. We do not merely mean such invariable and frequent phrases as "How do you do?" or "If you please," but rather those more subtle proverbial elements of conversation of which each one of us possesses, without even knowing it, an immense assortment. For instance, we say "as black as a crow," or "as black as ink," or "black as my hat," or "as black as a negro." "As white as snow," "as green as grass," "as blue as the sky," "as red as a rose," are all real compound elements of everybody's every-day vocabulary. "As old as the hills" comes naturally to our lips in speaking of age;

“as dark as pitch” in speaking of a moonless evening. “As drunk as a lord” is answered and balanced by “as sober as a judge”; “as merry as a grig” finds its true counterpart in “as jolly as a sandboy.” Sometimes we have half a dozen alternative forms for expressing the same degree of comparison; “as dead as a door-nail,” “as dead as a stone,” “as dead as mutton,” and “as dead as Julius Cæsar,” are all alike familiar to every one of us. “As soft as silk” immediately suggests as “hard as a stone,” and “as cold as ice” is contradicted at once by “as hot as blazes.” Probably a single person’s ordinary speech, if carefully watched for a whole twelve-month, would yield several hundreds or thousands of stock phrases framed on this comparative model alone; and there are dozens more sets of phrases equally common, running in the same way in big batches. For example, we might look at the stock phrases connected with sleep alone, such as “to take forty winks,” “to go to the land of Nod,” “to be in the arms of Morpheus,” “to have a little snooze,” “to go to Bedfordshire,” and so forth, till the reader’s patience is fairly tired. Or, again, we might instance the common sentences used about death, “to go to his last home,” “to be gathered to his fathers,” “to shuffle off this mortal coil,” “to go the way of all flesh,” “to fall asleep,” “to join the majority,” “to end his days,”

“to go to Davy Jones’ locker.” There is hardly an act or an idea in life about which we have not all of us unconsciously gathered a whole vast collection of proverbial phrases which we trot out and bring into use from time to time as occasion offers.

Then, again, there is the extraordinary variety of faces and features that we all remember, both those personally known to us and those merely recognized and remembered as belonging to neighbors or fellow-townsmen. It is probable that almost every human being recollects more or less distinctly, by name or face, not less than seven or eight thousand separate persons. This seems, indeed, at first sight, an excessive estimate, especially for the inhabitants of small villages and out-of-the-way places, where the whole population is small and fixed; but it has been arrived at by careful calculation and observation of cases, and on the average of instances it is probably true. For one has to remember not only all the members of one’s own family and one’s personal acquaintance, but also hundreds and hundreds of other people, with whom our intercourse has been but very slight, yet quite sufficient to make one recollect them. Think only of all the servants, landladies, tradesmen, assistants, policemen, cabmen, errand-boys, and hangers-on generally of whom one has a distinct and recognizable mental

picture. Think of the numberless people with whom one has travelled by rail or sea, and whose personality one can still more or less faintly reproduce to one's self. An excellent test for the enormous mass of human beings one can thus readily remember is to take a single summer holiday, spent in an unfamiliar town or village, and recall mentally all the people of whom one has still a definite recollection. There was the boy who helped down the luggage from the cab; and there was Mrs. Smith, the obliging hostess; and there was the bent old man who sat in the bar; and there was the fat landlord who discussed politics over his glass of toddy; there was Sullivan, the boatman, who had once been a coast guard; and there was the rosy-faced rector, who preached on Sunday; and there were the rector's five pretty daughters; and there was the pale curate who was so much snubbed by the youngest and prettiest of them. Why, it isn't difficult (we speak by book) to remember a hundred and fifty distinct persons all connected with those short three days at a seaside watering-place! And, when we come to multiply such instances by the hundred or the thousand, we see at once how vast and varied is the number of individual human beings held in memory by every ordinary modern man.

Equally astonishing, when one comes to look at the matter closely, is the immense variety of

Scripture texts and phrases, fragments of poetry, stock quotations, bits of hymns, and other fragmentary portions of literature firmly held in everybody's memory. Who does not know thousands and thousands of familiar tags, such as "To be or not to be," "Man wants but little here below," "All flesh is grass," "Let dogs delight to bark and bite," and so forth, *ad infinitum*? Add to these the general stock of common proverbs, "A bird in the hand," "A rolling stone," "Two of a trade," "The early bird," and all the rest of it, and then consider how vast is the accumulation to which they each separately bear witness. Or consider once more our acquaintance with the names, places, and facts of Scripture history, and then of history and geography generally. Try, for example, to recall to one's self all that every child knows and recollects about the Chinese Empire. Think first of the individual Chinaman, with his yellow skin, his oblique almond eyes, his twisted pig-tail, his queer dress, his clumsy shoes, his solemn demeanor; think then of his mandarins, his emperor, his small-footed wife, his quaint little children. Recollect his porcelain, his willow-pattern plates, his curious drawing, his aerial perspective. Recall his strange writing, as seen on china or tea-chests, and let that in turn bring up to memory his tea, his silk, his opium, his lacquer-ware. Then remember his religion, his

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temples, his pagodas, his joss-paper; and so continue till all one knows about himself, his country, his manufactures, and his customs is fairly exhausted, down even to his rice and his chopsticks, his ivory carvings, and his children's toys. Why, it is not too much to say that, if one were to write down deliberately in black and white all that an average schoolgirl of ten years old knows about China and Chinamen, it would run to a list of several hundred facts, of which we have here briefly enumerated in passing but twenty-eight! If anybody doubts it, let him take a pencil and paper for himself, and, after rigorous self-examination, allowing one point to lead up to another, write down in the form of a numbered catalogue every distinct and separate item he can possibly remember about the Chinese, their land, and their habits. He will probably be astonished himself at the result of the experiment. For, recollect that we have said nothing at all here about Peking and Canton, Shanghai and Hon Kong, the Summer Palace and the great rivers, the square-holed money and the vermilion pencil, the roast rats and the floating rafts, or a thousand other familiar commonplaces of undigested popular knowledge. The truth is that every individual human being carries about with him in his own head, without ever suspecting it, a vast collection of pigeon-holed facts and fancies, a store of mem-

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ory such as may fairly surprise its owner himself as soon as he begins really to examine the marvellous wealth and variety of its contents. Cell after cell and fibre after fibre in the numberless minute elements of the brain have been indissolubly connected by channels of nervous communication, impressed and modified by acts and ideas, till the whole has become a supreme register of past experiences, ready to be called up at a moment's notice by the wonderful power of association.

III.

SELF-CONSCIOUSNESS.

IF we were asked to state in a single word what purely personal characteristic has probably caused most misery to its innocent victims all the world over in this sublunary life of ours, we are inclined to think we should answer at once, not avarice, or jealousy, or temper, or love, but quite simply that commonplace feeling, self-consciousness. To be sure, love, we will admit—at the risk of being considered horribly cynical—runs it a neck-and-neck race for that bad pre-eminence; for who does not remember that half the tragedies and terrors in this earthly life of ours have had their ultimate basis and groundwork of being in the tender passion? We know at once that our girls have reached the age of love-making when we see their eyes pretty constantly red with crying in the early morning. Nevertheless, even in spite of this most serious competitor for the post of honor as a general misery-monger, we are still disposed to place self-consciousness in the very first and foremost rank as a common cause of human distress. To every one person who suffers from the pangs

of jealousy, of fear, or of unrequited affection, there are a hundred who suffer from the terrible, pressing, and ever-present demon of mere self-consciousness.

It is not a vice, or, at least, only a very small one; it is not even a failing, or a weakness, or a peccadillo; it is, after all, a pure misfortune. It injures nobody but the person himself who feels it—or perhaps one ought rather to say the person herself who is its subject; for, though men and women alike suffer in secret from this horrible scourge, it chooses its victims most particularly among the young, the timid, the modest, and the beautiful of the fairer sex. A philanthropist who had it in his power to abolish, if he chose, with a single wave of his hand either small-pox or self-consciousness, would probably do more in the end to diminish human suffering and to increase human happiness if he elected to get rid by a heroic choice of the less obtrusive but more insidious and all-pervading disease. For small-pox, at the worst, attacks only a very insignificant fraction of the whole community; while every second person that one meets in society, especially below the age of fifty years, is a confirmed sufferer from the pangs of self-consciousness.

Of course, to be self-conscious is a very different thing indeed from being conceited or egotistic, and still more different from being absolutely and

utterly selfish. Selfishness is a real vice — or, to speak more correctly, it is all the vices rolled into one. The purely selfish man is incapable of almost any form of active virtue, except, perhaps, truthfulness; he is the meanest and smallest and most despicable of created beings. Egotism, again, is a far less serious though a more ridiculous failing than selfishness; the egotist, though not perhaps unkindly or ungenerous, thinks perpetually of himself as the centre and focus of all other people's thoughts, the happy cynosure of neighboring eyes. He makes himself absurd by the overstrained importance he attaches to his own dignity and position; he considers himself the handsomest man in the whole room; he admires the cleverness of his own conversation; he laughs the loudest at his own poor jokes. His complacency, however, ridiculous as it really is, gives immense pleasure to himself, and is, after all, only a source of innocent amusement to other people. If he gets laughed at, it is behind his back; and the light shafts of other men's ridicule never pierce the thick hide of his pachydermatous personality. So far as his own feelings alone are concerned, the egotist is a man rather to be envied than to be pitied, a subject for laughing congratulation rather than for sympathetic condolence and brotherly regret.

It is far otherwise with the miserable victim of the self-conscious torturing-rack. He or she has

no such profound conviction of immense superiority to the common herd of ordinary people. Your nervous young man may really have brains, common-sense, fair talking powers, and agreeable manners; but the moment he finds himself in the society of his fellow-creatures he becomes a prey at once to this hideous form of introspective analysis, this inability to divest himself for a moment of his own abiding and obtrusive personality. Let the talk turn on politics or literature, on art or on gossip, he is not thinking of the presidential campaign or the state legislature, of Mr. Gladstone or the Redistribution Bill, of Tennyson's new poem or Howells' new novel, of the fashionable picture at the Academy or the remarkable sensation at the Lyceum, of Mrs. Smith's nice little dinner or of what a bad match Ethel Jones is going to make with that young fellow in the Hundred and Fiftieth; all these subjects, which are being discussed with so much animation and *verve* all around him, fall absolutely flat upon his inattentive ear; what he is really thinking of is simply himself, and whether other people are or are not thinking about him. If he ventures a critical remark as to the conduct of the hero in the latest romance, or endeavors to defend Ethel Jones against the charge of imprudence in marrying a young man without a penny, he cares really in his own heart less than nothing about either hero or young lady; what he

cares for is in the last resort merely the effect his remark may be supposed to have upon the surrounding listeners. Not that he is striving after effect, poor fellow! He is far too nervous and self-conscious for that. All that he desires is, without absolutely effacing and annihilating himself, to escape notice in the unnumbered crowd of his fellow-creatures. He wishes to live what poets advise us all, a life of obscurity. If he makes a remark, it is dragged out of him by a stern sense of the absolute necessity of saying something. He speaks, not because he has something he desires to say, but because he feels other people expect him to contribute his poor little quatum to the passing conversation.

In the case of women the miseries of self-consciousness are even more poignant and more unendurable. A girl may be pretty, engaging, attractive, modest; she may have a sweet disposition and a sufficient stock of intelligence for the world at large, as at present constituted; but, if once this terrible demon of self-reflection takes possession of her, she will never know another hour of quiet happiness in the society of her unsuspecting fellow-creatures. How am I looking? What are they thinking of me? Am I pale to-night? Have I an unbecoming color? Am I saying everything I ought to say? Have I put my foot into it with anybody? Oh, how

miserable I feel! If I were only safe at home again!

Oh, if I were dead now,
Or up in my bed, now,
To cover my head now,
And have a good cry!

What girl is there who has not at some time or other experienced this horrible, sinking, inexpressibly uncomfortable feeling?

It is young men and young women, indeed, who are the chief victims of the self-conscious mania. In youth, and especially before marriage, lads and girls are naturally anxious to please and produce a good impression upon one another. In perfectly healthy, unsophisticated persons, such a desire merely takes the unimpeachable form of sprightliness and a pleasing effort to make themselves agreeable to other people. But in nervous and self-regarding natures it takes the form of a constant and ever-present prying into the reception that others are giving them, — a pervading consciousness of self, which never leaves them even in the midst of the most distracting conversation or the most engrossing society. Instead of thinking about what is being said and what is being done, they are thinking all the time of what is being thought of their own personality.

And herein consists the real error and blunder

of the self-conscious mind — the error of attributing a vastly exaggerated importance to its own individual self. In the last resort, self-consciousness is only egotism turned inside out; while the conceited man is a contented and well-satisfied egotist, the self-conscious man is a discontented and self-distrustful egotist. The only rational cure for this great radical evil lies in the earnest endeavor rightly to appreciate one's own individual insignificance as a unit in the great complex mass of human society. When the self-conscious man goes into a room, he fancies that every one of the people in it is thinking about him, watching him, observing him, criticising his every word and movement and action with the same eagerness that he feels about them himself. But they are not; they are each of them doing exactly the same as he is — thinking of themselves, and wondering what opinion, in Heaven's name, he is forming about them! "What a dreadfully silly thing I said to Mr. Brown!" poor Miss Jones exclaims to herself, with crimson cheeks, in the solitude of her chamber, after she comes back from the Jenkinses' little evening-party. "What on earth can he ever have thought of me!" "What a fool I made of myself to that nice little Miss Jones!" Mr. Brown observes, contemplatively, as he exchanges his evening-shoes for the comfortable slippers of unclaimed bachelorhood. "How dreadfully silly she

must really think me!" But neither says what a fool the other was ; each is engaged in thinking, not of his or her neighbor, but of the impression his or her neighbor has formed of himself or herself. We are all perpetually playing at cross-questions and crooked answers. Each is absurdly anxious about the effect produced by himself, but absurdly cool and disdainful about the effect produced by others.

Whoever wishes to be cured of this ceaseless internal torture should school himself carefully in the habit of remembering that everybody else has his own doubts and fears and hopes and peculiarities, his own tremors and blushes and joys and gratifications. If, poor victim, instead of troubling yourself only about what Robinson thinks of you, you sometimes try to think whether you are doing your best to give pleasure to Robinson, you will soon find that the endeavor to concentrate your attention upon somebody else's mind has taken it for the moment off your own eternally nagging personality. Depend upon it, most people think more about what is being said and done around them than about the people who are saying and doing it. If the conversation happens to turn upon Lord Wolseley's recent movements in Egypt, Mr. Tittlebat Titmouse, venturing with a little flutter of hesitation to express his personal ideas upon the general's capacities as a strategist,

imagines in his own mind that everybody else is thinking in his soul, "This is Tittlebat Titmouse's deliberate opinion." But everybody else in that little group of talkers is thinking not in the least about Tittlebat Titmouse and his private lucubrations; they are all thinking about Lord Wolseley and the Egyptian expedition—or about themselves. We each unconsciously exaggerate to ourselves our own relative importance as parts of this great complex whole which we call the world; we consider ourselves the centre of the universe to everybody else, whereas we are really only the centre for our own little restricted individuality. Oddly enough, truly great men and women are generally quite devoid of the faintest shadow of such self-consciousness; they are so filled with the subject which holds them for the moment that they forget themselves in the passing interest of the conversation. To be sure, there have been a few great self-conscious geniuses—Byron, Lord Lytton, Victor Hugo, and half a dozen more of the same kidney; but it is always noticeable that their influence is greatest with their own contemporaries, and fades away slowly into nothing as subsequent generations gradually forget them. It is the great self-forgetting and self-suppressing geniuses of the world—the Homers, the Aristotles, the Virgils, the Dantes, the Shakspeares, and the Michael Angelos—whose fame lives on

and grows and expands often in the midst of absolute ignorance as to their private life and personality.

For the fact is, nobody, as a rule, is much interested in other people's most internal personality. An autobiography, unless it be the autobiography of a very great or a very peculiar personage, rarely excites much attention among general readers. Self has been well described, indeed, as that subject upon which all men are fluent and none agreeable. Hence even geniuses, when profoundly self-conscious, fail to interest any save their own passing generation. After-ages get tired of their distorted pictures of what they take to be their own souls. They turn rather to the really great objective writers, the Homers and Shakspeares and Chaucers and Molières, who never trouble at all about themselves, but put upon the canvas before us the living images of men and women. If even exceptional natures, then, thus fail to attract us when too self-conscious, how can ordinary every-day average people hope to prove acceptable to one another, unless they make an effort to cast aside this perpetual habit of thinking of nothing but their own idiosyncrasy? The self-conscious should make a deliberate attempt to free themselves from the trammels of their own point of view, — to think of others, to feel for others, to sympathize with others, and to forget self in the

settled determination to be wider-minded and more objective in attitude — better even to think healthily and unconcernedly about the merest trifles than to pry too much into the deepest recesses of one's own feelings. If we leave our feelings altogether alone, indeed, we shall soon be surprised to find that, so far as self-consciousness goes, we have ceased to have any. We shall have merged the consciousness of self in the general service of universal humanity.

IV.

ATTAINABLE IDEALS.

BENJAMIN FRANKLIN, philosopher and electrician began life as a journeyman printer, and he lived to occupy the distinguished position of United States Minister in Paris and London. But it is immediately evident to the meanest comprehension (and much more, then, to the intelligent reader) that not more than one compositor at a time can ever fill the post of ambassador extraordinary from any one great power of the world to the court of another. The vast mass of deserving journeyman printers must perforce be otherwise provided for, and in ninety-nine cases out of a hundred, we shrewdly suspect, must remain journeyman printers still to the end of the chapter. Indeed, in spite of the excellent example for emulation afforded them by the career of Franklin himself, we do not recollect that any other American compositor has ever been duly accredited by his own government to the occupant for the time being of the Tuileries or St. James'. William Herschel, organist and astronomer, started in the world as oboe-player in a German regimental band,

and he ended his days in the dignity of knighthood, as keeper of King George's private observatory at Kew. But not more than one German bandsman at a time can ever hope to preside with distinguished success over the great national institution at Greenwich or Washington; and it has not been noticed that Sir William Herschel's marvellous energy has succeeded in inspiring future musical performers with any profound interest in the science of astronomy. So, again, George Stephenson, engine-driver and inventor, was brought up in a north-country colliery-village, where he ran about barefoot among the trucks and coal-heaps throughout his entire boyhood, never even learning to read and write till he was over twenty; but he lived to invent the first truly practicable locomotive, and he died a millionaire among his halls and gardens, his peaches and his pineries. Yet no large proportion of north-country colliers have since collected fortunes of five million dollars; nor is it conceivable (even if it were desirable) that any great number of people together should ever rise to such a high and giddy pinnacle of wealth. To be President of the United States, to be Prime Minister, to be Archbishop of Canterbury, to be Lord Chancellor, to be the greatest painter, or the leading physician, or the most popular author, or the finest singer, or the biggest land-owner, or the richest merchant in

all America — these are necessarily special distinctions which can fall to the lot only of a single man in each generation, and each such man must himself be born, to start with, in possession of very exceptional and unusual endowments, of greater or less genuine importance, according to the particular distinction aimed at.

It has often struck us, in reading the numerous biographies of so-called “successful men” which are put forth in thousands of copies by well-meaning people, that this original and obvious distinction was too often systematically slurred over and so obscured. “Look at John Gibson!” the working stone-mason is patronizingly advised. “He was only a common stone-cutter like you; and yet he rose to be the greatest of all modern English sculptors.” True; but then it is forgotten that he started by being John Gibson, and that, if a hundred average hard-working and intelligent journeyman stone-cutters were to go to Rome on foot and study sculpture and work their fingers to the bone all their lives long, the chances against any one of them ever turning out a tinted Venus or a Psyche and the Zephyrs would be practically almost infinite. “Look at Abraham Lincoln!” the American farm-boy is affectionately counselled. “He was only a common laborer like you; and yet he rose to be President of the United States, and to guide his country safely through the very

death-throes of a terrible crisis." True ; but then it is not added at the same time that Abraham Lincoln was a born statesman, and that agricultural laborers generally do not go about the world like unfledged Presidents, with the inner consciousness of their glorious potentiality of swaying a great empire as their chief encouragement while they hoe potatoes. Every French soldier, we are often assured, carries a marshal's *bâton* hidden in his knapsack ; but most of them carry it in their knapsacks till the day of their death, without ever having the chance of producing it openly at a review at Longchamps. If they did not do so, what would become of the rank and file, and where would the necessary pay be found for so many generals? The Army of the Republic of Haiti is the only one known to exist at the present moment in which the number of field-officers actually exceeds the number of privates ; and the Republic of Haiti is not regarded even by the friends of freedom as a distinguished triumph of the human intellect.

The real ideal, we take it, which ninety-nine out of a hundred of us ought soberly and honestly to place before ourselves, is not the ideal of "getting on" into another rank, but the ideal of doing the best and highest work we can in the station in life in which we actually find ourselves. Not that we would for one moment discourage the favored few who really feel that they have it in them by their

own exertions to rise superior to the lot in which they were born. The great catalogue of "the men who have risen" contains probably the vast majority of all those names which the human race is most likely to remember always with joy and gratitude. The thinkers who have given us the noblest thoughts, the workers who have most improved the conditions of human life, the benefactors of their kind whose great inventions or discoveries still live amongst us, have for the most part been self-made men, and have started in many cases from the very humblest and simplest beginnings. But such men have already encouragement enough and to spare; there is no fear that the spur of personal ambition will ever fail in inducing those conscious of great and exceptional abilities from applying them to the very best possible advantage for themselves and their fellows. The danger of hiding our light under a bushel is not one to which most of us in these latter days are conspicuously liable. On the other hand, it is quite possible that at all times, and especially in these present days of rapid expansion and universal education, the mere material gospel of "getting on" may be preached too strenuously, too often, and too well. There is a real danger that excessive stress may be laid upon the actual or imaginary practical results of teaching and effort, that hopes may be encouraged which are in their own nature incapable of

wide or general fulfilment, that an accidental and exceptional effect may be mistaken for the true use and main value of better education. Let us illustrate our meaning by a simple and naïve old English saw. "When land is gone and money spent, then learning is most excellent," says the ancient proverb, thus staking the whole importance of education, as it were, upon its mere incidental and casual use as a last resource, a something to fall back upon in case of a serious reverse of fortune. It says, in fact, to the aspiring and intelligent young woman of the period — "You had better do your best to learn hard now that you are young, for if your husband — when you get one — should happen to die and leave you unprovided for, you will then be able at least to open a ladies' school." Could any ground be more ridiculous on which to base the claims of learning? The infinite every-day uses and joys of knowledge and culture are overlooked in favor of a remote and doubtful contingency. And yet it is on grounds scarcely less ridiculous than these that young men and boys are often called upon by well-meaning advisers to exert themselves to the utmost in their own trade or profession. "Be diligent in taking round your loaves of bread every morning," we say in effect to the London baker's boy, "and then, perhaps, when you grow up, you may rise to be First Lord of the Admiralty." "Learn all you

can, and work hard," we say in effect to the common-school scholar, "and then, perhaps, when you come to be a man, you may live in a handsome brownstone mansion in Euclid Avenue, or drive the finest trotting horse in Central Park on a show day."

Now all this may be true in its way, and in a small number of exceptional instances it is really true for boys and men endowed with unusual natural endowments, or with a superior gift for the art of money-making. But the great aim of education, as a rule, ought certainly to be not to enable every one of us to rise into the position of United States Senator, or President of the British Association for the Advancement of Science — which, as Euclid would say, is absurd — but to enable every one of us to live well, fully, and nobly the particular life for which each in his way is best fitted. Not what we do, but what we are in ourselves, is the main question. It is relatively unimportant to humanity at large whether we belong to this, that, or the other grade in society, whether we make boots, or sell books, or dispense medicines, or direct and oversee national undertakings; what is really and fundamentally most important of all to the community as a whole is that we should each be as well adapted as possible for the functions in life we have severally to perform. There are some good but nervous peo-

ple who talk about the danger of educating young men and women above their stations. Has anybody ever yet seen a man or woman who was thus overeducated? We have all met hundreds and thousands of people who were not well enough instructed or trained for their stations; but we never remember to have met anybody who had too much knowledge, or too much culture, too wide an acquaintance with the great works of literature, too deep an insight into the great truths of science and of nature. Nor do we quite see how such a thing is even possible—how any man, however humble his sphere, can have trained too highly his own tastes and his own faculties, can be too intelligent, or too cultivated. Similar tastes and similar faculties may be rare at present in the particular class to which he belongs; but that is no reason for saying in a condemnatory sense that their possessor is overeducated. It is a reason really for endeavoring to interest as many more persons of his class as possible in the same direction. There is a common navvy employed on some railway works in the west of England who has a marked taste for antiquities, and a really considerable acquaintance with the remains of prehistoric man. He has collected with knowledge and skill a small museum of old stone implements, and he wears—for love of it—an ancient British gold coin of some rarity and value

as an ornament on his watch-chain. A great many other navvies, it is to be feared, if they had found the coin, would have sold it at once for its highest market-value, and contributed the greater portion of the proceeds to the joint benefit of the revenue and the licensed victualler. But that is no reason, so far as we can see, why we should say the particular navvy in question has acquired tastes above his station. It is to be hoped that, as time goes on, all our navvies will not indeed be converted into professors of archæology in the Universities, but that more and more of them will every day be induced to follow this good example, and to take an interest, we do not say necessarily in stone implements and ancient British coins, but in something other than the coarse and vulgar pursuits to which it may be feared most of the class are at present addicted.

For this reason, it has often seemed to us, lives like that of Thomas Edward, the Banff shoemaker, who devoted his whole spare time to the study of marine animals, or that of Robert Dick, the Thurso baker, who became one of the most successful and useful of British botanists, are far more really encouraging in their way to the people for whose encouragement they are specially intended than any number of glowing biographies devoted to the doings of the "men who have risen," and have ended by accumulating for themselves, through

fair means or foul, gigantic fortunes. Edward and Dick did not rise; in the ordinary vulgar sense of the words, their lives could not be considered by any means successful; the one remained a mere cobbler, and the other continued to fire the baker's oven to the end of their days. And therein consist the true value and lesson of their history. They never raised themselves, by mere "getting on," above the position in which they were born; but they enjoyed in that position intellectual pleasures and cultivated fellowship which are rarely reached by any even of those far, far above them in the social scale. They corresponded on equal terms with learned men of science in all parts of the kingdom, and they were visited and appreciated by those whose appreciation they would have most valued as a tribute of admiration. But—more than that—they passed their own lives happily and usefully in the absorbing and delightful pursuit of natural knowledge; they drank to the full of all that was known and thought in their own time on the very profoundest and most interesting of questions, and they had the satisfaction of knowing that by their own humble amateur-work they had contributed materially to the solution of some among these higher problems which more learned men than themselves had in many cases long failed to grapple with. Such lives as those are surely, in the

truest and noblest sense, perfectly successful. We would not, indeed, for a moment be thought to undervalue the worth of thrift and providence. We firmly believe that every man's first practical duty in life is to provide adequately for the immediate wants of himself and those naturally dependent upon him, and to lay by to the utmost of his power what is needful for their future sustenance and comfort. We honor, as far as is right, the honest, honorable, and worthy ambition to get on, in the ordinary sense of the term. Still, so far as broad, general facts are concerned, it must be obvious to everybody that the very existence of a great civilization implies the constant and continued existence within it of endless bands of workers of every kind — agriculturists, mechanics, factory-hands, seamstresses, producers of all sorts in infinite variety. It is not possible that all these, or any great proportion of them, should ever raise themselves to be anything else save what they are at the present moment; the conditions of things are clearly opposed to such a supposition — you cannot introduce an act of Congress to abolish corn-growing. But it is possible that all or a very large number among them should have their standard of comfort, of taste, of morals, and of intelligence considerably raised above its present level; that, while retaining essentially their present position, they should become better

read, better informed, better behaved, and better instructed — perhaps also better housed, better fed, and better supplied with simple luxuries — than many among them are nowadays. This is the true, realizable ideal for all masses viewed as masses; the notion of all raising themselves, each by his individual exertions, to a better social position (as the words are now generally understood) is a mere chimera; but the notion of all raising themselves as a body by each attaining higher interests and higher levels of culture is in every way a practicable and a desirable one. Toward this end all social progress ought properly to direct itself; it should aim at the general elevation of classes, not at the particular elevation of individuals from one class into another. To make the great thoughts of poet and philosopher, of essayist and thinker, of scholar and orator, familiar to every English and American lad and maiden; to bring home art to the firesides of the million; to diffuse the wonderful discoveries of science among the widest possible appreciative audiences; to stimulate all the higher tastes for music and reading, and country scenery, and the study of nature, and the delights of all æsthetic sense — this is a true means of making thousands of lives more really successful — that is to say, happier, fuller, and worthier of a reasonable creature's living — than they are in the present condition of society. The

man who secures a moderate competence, according to the ideas of the rank in which he was brought up, and who passes his leisure time in constant spiritual intercourse with Shakspeare and Milton, with Locke and Emerson, with Reynolds and Gainsborough, with Beethoven and Mendelssohn, with cloud and sunset, with bee and butterfly, with fern and flower, and with the deep response of human sympathy, has surely succeeded in life immeasurably more truly than if he had spent his entire time poring over the delightful details of his ledger and day-book, and had died leaving a personalty valued for probate at not less than one hundred thousand pounds sterling.

V.

INSTINCT AND REASON.

ONE of the cheapest, easiest, and worst ways of settling any delicate distinction is that of drawing a hard and fast artificial line, so as to cut off the doubtful or border cases by a dogmatic definition. Where, for example, does instinct end, and where exactly does reason begin? "Oh," say many excellent people, with the off-hand glibness begotten of thoughtlessness, "men have reason and animals have instinct!" — and, having delivered themselves forthwith of this simple and effective judicial summing up, they dismiss the case from court immediately, as not deserving of further hearing. Well, of course, if we choose thus dogmatically to cut the Gordian knot by decreeing that instinctive actions, when they appear in man, shall be set down verbally as due to reason, while efforts of reasoning, when they appear in the lower animals, shall be contemptuously regarded as beautiful examples of a developed instinct, there is nothing more to be said about the matter. But such a purely verbal and delusive decision does not really alter in any way the underlying identity

of human instinct with animal instinct, or of animal reason with human reason. It has been abundantly demonstrated of late years both that man possesses true instincts and that some animals, at least occasionally, display true reasoning powers. No doubt, in man the instincts are reduced to comparatively small dimensions, while the reason has attained an exalted position far above what it ever attains in the highest brutes. But that consideration must not blind us either to the fact that we do really share with the animal world in the great and valuable endowment of instinct, or to the converse fact that animals do really share with us, to a less degree, in the far greater and still more valuable endowment of reason. These two complementary principles have now for some years been almost universally acknowledged among naturalists, physiologists, and men of science; it is time that they should come to be more generally recognized as true by the public generally, learned or unlearned.

In the first place, then, by way of deciding whether human beings do or do not share in the gift of instinct, let us begin by asking the prior question, "What is an instinct, and how do we know an action to be instinctive when we observe it?" Instinct has been admirably defined by Dr. Bain as an "untaught ability" — that is to say, an ability inherited by a race as part of its mental

nature, and not requiring to be definitely taught it. Thus, for example, the art of building honeycomb is an instinct with bees. They do not need instruction from one another in the mode of forming their regular hexagonal cells with wax; as soon as they are fairly hatched from the grub state, they begin to work upon constructing comb, gathering honey, feeding larvæ, and attending to the wants of the queen bee, as if they had been accustomed to nothing else but such adult activities. So, too, with the spider's web, the bird's nest, the curious habits of ants and wasps and burying beetles and processional caterpillars. To take a single well marked case — that strange insect, the ant-lion, forms, with astonishing labor, a funnel-shaped pitfall in a dry sandy soil, and buries himself up to his neck in the sand at the bottom, leaving only his great jaws visible above, and thus lying in wait patiently in ambush for his expected prey to fall into his mouth. When an ant or any other small insect happens to walk on the edge of the pitfall, it knocks down a little of the sand on the sloping bank, and so gives the ant-lion timely notice of its passing presence. Instantly the tiny carnivore in his hiding-place below throws up the sand like miniature artillery to overwhelm the ant, and soon brings his victim down to the bottom of the trap, between his greedy jaws. But all this, which so closely re-

sembles rational prevision, is nevertheless in reality a purely instinctive action; any ant-lion hatched out of the egg, away from all others of its kind, and allowed to follow its own inherited habits undisturbed, will immediately begin to construct an ant-pit on its own account, quite apart from any possibility of intercourse, imitation, or deliberate teaching. This may be regarded therefore as a good typical instance of a true instinct — an inherited aptitude independent of instruction or conscious experience.

Now the question is, Do human beings possess any such inherited aptitudes, any instinctive activities which manifest themselves prior to all teaching or knowledge of their effects? The answer to this question must inevitably be, Most certainly they do. If we put the mouthpiece of a feeding-bottle to an infant's lips a few minutes after birth, the child will at once close its mouth upon the tube greedily, and begin to suck with all its might. This action is not rational; the baby has no knowledge of the fact that the bottle contains milk, that milk is good for human food (especially in the case of the human baby), and that the way to get at it is by closing the lips and taking a good pull at the mouthpiece. It sucks purely and entirely by instinct; the impulse to purse up its lips and draw in its breath is an untaught ability, an inherited aptitude, a habit

inherent in its nervous system, and handed down to it from all previous generations of human babies from time immemorial. Perhaps this may be regarded as the very best instance of an instinctive action among human beings, and it must certainly rank among the most important from the point of view of the preservation of the species; for, if, by any conceivable accident, our babies were all unanimously to forget the way to feed themselves and refuse to suck, it is clear that humanity would very shortly become as extinct upon our globe as the mammoth and the mastodon. But there are several other instincts, less marked, it is true, yet not less real — which persist with all of us throughout our whole lifetime. There is the instinct which prompts us to wink or close our eyes before an excessive flash of light, a blow aimed at the eye, or the sudden approach of an insect, dust, a twig, or any other dangerous object. Babies close their eyes instinctively if menaced with a blow, though they do not know that the eye is a specially sensitive part, or that injuries to it are peculiarly painful and disabling. As long as we live the instinct persists, and, as it acts far more quickly and surely than reason, it saves many of us, no doubt, on numerous occasions, from the chance of blindness or serious hurt. Instincts of self-preservation of many sorts also occur in man, and are never got rid of to the very end, even by

our preponderatingly intellectual and rational education.

On the other hand, there can now be very little doubt that many of the lower animals possess distinct and decided reasoning faculties of a low grade. To take an example from a comparatively humble and despised animal, here is a case of apparent reasoning cited by Mr. Darwin on the part of a crab. A competent observer was watching a shore-crab making its burrow, and he threw some shells over towards the hole, just to see what the crab would make of them. One of the shells rolled down the sides of the burrow, and three others landed on the edge a little way off. In about five minutes the crab appeared at the mouth of his tunnel, carrying out the shell that had fallen in, and removed it safely to the distance of a foot. On his way back he saw the three other shells lying close by, and, regarding them closely, evidently reflected that they were very likely to roll in too. So he lifted them up carefully in his jaws and deposited them in safety beside the first that he had removed from the burrow. Now it is clearly mere verbal juggling to call such a deliberate act as this instinctive. The crab had no inherited knowledge of the fact that shells are liable to roll into crab-burrows; he merely reasoned from his experience of the behavior of one such shell to the probable behavior of others

like it. And it is just this power of learning from experience, of drawing an inference from one case to guide us in another, that we call reason. As Mr. Romanes well says, "If I were to see a large stone falling through the roof of my conservatory, and, on climbing to the wall above, saw three or four stones just upon the edge, I should infer that the stone which fell previously stood in a similar relation to my conservatory, and therefore that it would be desirable to remove the others from their threatening position. This would be an act of reason (though a simple one); and it is identical with the act which was performed by the crab." To deny this is to give two different names to what is essentially one and the same mental act, not because of any real difference in the act itself, but because of differences in the dignity of the creatures which happen to perform it. Such verbal juggling can never lead to any clear or good intellectual result.

Another instance of undoubted reasoning in an animal far higher in the scale than the crab who performed this bit of syllogizing is related by Dr. Bastian of an orang-outang in the menagerie of the Botanic Garden at Paris. This intelligent beast was accustomed, when the dinner hour had come, to open the door of the room where he took his meals in company with several persons. As

he was not sufficiently tall to reach as far as the key of the door, he hung on to a rope, balanced himself, and, after a few swings, very quickly reached the key. His keeper, who was rather worried by so much exactitude, one day took occasion to make three knots in the rope, which, having thus been made too short, no longer permitted the orang-outang to seize the key. The animal, after an ineffectual attempt, recognizing the nature of the obstacle which opposed his desire, climbed up the rope, placed himself above the knots, and untied all three. The same ape wishing to open a door, his keeper gave him a bunch of fifteen keys; the ape tried them in turn till he had found the one which he wanted. At another time a bar of iron was put into his hands, and he made use of it as a lever. Similar instances of comparatively high reasoning powers in dogs, horses, elephants, pigs, parrots, foxes, cats, and donkeys have been collected in numbers of late years, and published with excellent authenticating letters in various scientific journals and transactions. Cases of the sort are, of course, totally different in kind from the mere instincts, however admirable, of the beaver, the ant, the cuckoo, and the bower-bird. These instincts are always directly connected with the inherited habits and mode of life of the race, and are the same for all its members in all circumstances; whereas the oc-

casional exercises of true reason by beasts or birds always take place in exeptional conditions, and often in circumstances which can seldom or never have occurred before in the history of their kind. For example, no orang-outang in the wild state is ever likely to come across a rope with three knots in it, or to wish to open a locked door by trying all the keys of a bunch, or to employ a crowbar by way of a lever, in order to force a fastened lock. All these are things that can have happened but seldom in the whole past history of orang-outangdom.

Indeed the most modern theory of the origin of instinct refers it in almost every case to primarily intelligent acts, so often performed by each race that the mode of action has at last become ingrained in the nervous system, and hereditarily handed down, independently of experience. If this theory be really true—and it is a theory which obtains every day more and more of assent from the scientific world—then instinct itself must be regarded as a sort of organized and registered tribal reason, the inherited intelligence and experience of an entire race, grown by practice into an invariable habit, and indelibly fixed, as it were, on the very brain and nerves of every individual in the whole species. Birds, we may suppose, first learned to build their nests by slow trials, much as human beings have learned to build their houses;

but they went on building them all in the same way until at last every bird of each kind inherits at birth the nest-making faculty exactly as it inherits wings to fly and feet to perch with. So, too, the swallows may have convinced themselves by slow experience of the advantages of migrating and the ants may have gradually acquired the habit of foraging in regular parties along fixed highways. We know, indeed, that the retriever has been regularly taught to retrieve and the terrier to worry; yet so instinctive have those two habits now become in the two breeds that, if you throw a handkerchief down to a young retriever puppy, he will bring it over and lay it at your feet as if it were a game-bird; while if you throw it to a baby terrier, he will shake it in his teeth savagely, as if it were a rat. Sheep in Spain are driven every year by their owners from the parched lowlands to the mountain pastures; and in the course of generations this acquired habit of migrating has become so ingrained in the very brains of the merinos that as the time for moving approaches they begin to exhibit uneasy feelings exactly like those of wild geese or other migratory birds at the advent of the season for the annual flight. It is not improbable, therefore, that instinct is in many, if not in most, cases a form of lapsed or organized intelligence — a result of what were once reasonable inferences from experience acting

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now with blind regularity quite apart from any distinct individual consciousness of the end intended or the means employed. It may be considered perhaps as a kind of organic, unconscious reason, more rapid and certain, but less discriminative and plastic than true individual intelligence, which is always based on conscious experience and on the deliberate adaptation of means to end. Instinct always acts immediately, but it also often acts wrong; reason usually hesitates and deliberates, but it leads oftener in the end to the best result. In proportion as any creature rises higher in the scale of life, it will be guided less and less by inherited faculties and more and more by individual experiences—it will become decreasingly instinctive and increasingly rational—it will subordinate the lower to the higher faculty. That is why in man the instincts are comparatively broken and enfeebled, while the reason is comparatively advanced and supreme.

VI.

SLEEP.

MAN is certainly to a marvellous degree a creature of habit. Every day at a fixed hour — barring accidents — the vast majority of us sit down to the domestic board and proceed incontinently to eat our dinners, without having ever once paused to inquire, “Why on earth should we always go through this remarkable and somewhat monotonous daily proceeding?” To be sure, we do not mean to assert that man is more a creature of habit and less inquisitive in this respect than other animals, for we do not for a moment suppose that a philosophic tiger, in full sight of a nice, juicy, tender antelope, ever stopped and eyed his victim abstractedly, while he asked himself the metaphysical question, “What is the ultimate end of eating?” Still it is a fact that most of us do actually go on consuming food all our lives long, without any except the very vaguest possible idea that it is in some way necessary for keeping up the strength of the body. We know that, if we did not eat at all, we should starve to death, and that, if we even went without food for a whole

day together, we should suffer from a very inconvenient internal gnawing which we call hunger; and that knowledge is quite enough for almost all of us, without any further minute prying into the exact details of the digestive process. Nature has quite sufficiently endowed us with an immediate inducement to do our duty in this respect, by providing us with the sense of taste and the feeling of appetite. It is just the same with sleep. Night after night, as the clock points to the accustomed hour, we all betake ourselves to what Mr. Dick Swiveller elliptically described in his own peculiar dialect as "the downy," and there seek with varying success to court what the same eminent linguistic authority has christened "the balmy." If asked why we want to spend nearly half our lives in bed, and why we wish at that particular moment to do the very same thing that we have done every night of our lives already till we ought to be tired of it, a few very philosophical people might indeed answer, "Because we are in need of rest"; but the world at large would certainly respond in cheerful innocence, "Because we're sleepy." Nature has provided that wise and foolish, philosophers and ignoramuses, should all alike take the necessary repose, whether they know the reasons for doing so, or whether they know them not; and that is certainly one of the advantages of being a creature of habit.

Yet, if we look a little deeper into the matter, the question "Why do almost all animals require this nightly period of rest and unconsciousness?" is surely one that calls for a rational and comprehensive answer. It is easy enough to say glibly, "Of course we need repose"; but, after all, this merely appears to be a sufficient reply because we are so accustomed to the fact itself; it is no explanation—it is simply a re-statement of the original problem. Stones do not require a special period of repose, nor do plants, nor even some of the lowest animals. Nay, in the human body itself there are two important sets of organs which work on ceaselessly, night and day, never pausing or resting,—the heart and the breathing apparatus,—and there is at first sight no apparent reason why one part of our frame should need such extended repose, while another goes on moving and acting with unfailing freshness from year's end to year's end. However deep our slumber may be, the blood is still being pumped up vigorously through its channels by the powerful muscles of the heart, and the breath is still being regularly drawn in and out by the slow and even movements of the gently rising and falling chest. Some sufficient reason must certainly exist why heart and lungs should differ so conspicuously in this respect from brain and limbs. If we consider the true nature and meaning of sleep, we shall see that such a

reason can actually be assigned for this remarkable difference.

In the world at large, night follows day with unerring regularity; and night is a time when most animals cannot readily perform their usual functions, or exert their usual activities. To be sure, there are some small eyeless creatures which swim about in ponds and rivers, or in the depths of the sea, to which night and day are all the same, and yet in whose simple little organization the necessity for sleep has never yet arisen. Furthermore, there are some specially nocturnal animals, even among the higher grades in the world of nature, such as bats, owls, and badgers, whose peculiar case must be considered later, as exhibiting the true object of sleep in a very special and topsyturvy manner. But taking the earth as a whole, no fact is more conspicuous in its arrangement than the fact that life generally is vivid and active during the hours of daylight, while it is suppressed and dormant during the hours of night. To creatures with eyes — excluding for the time being a few obvious exceptions already noted — day is of course the natural time for seeking food, for building nests, or digging burrows, for performing all the thousand and one varied acts of every-day life, either of the lower world or of humanity itself. The enormous majority of our dumb fellow-creatures walk or fly about freely in the open

sunshine, and retire to their dens, holes, or burrows with the shades of night. In other words, day is the most convenient time for action, and night is the most convenient time for repose and rest.

Now, whatever part of our bodies is exercised at any moment is thereby to some extent used up and rendered less fit for similar exercise in future. This is true even with the apparently untiring heart itself. At each pulsation it uses up a portion of its strength; but in the very slight interval between the pulsations it rests; and during that brief moment of rest it rebuilds and restores itself against its next effort. The interspace of repose is there indeed exceedingly short and almost imperceptible, yet in that fleeting fraction of a second the tissues of the heart find time enough to extract from the circulating fluid a store of nourishment sufficient to replace them on a sound working basis. But in most parts of our bodies the intervals of work and restoration are far more protracted. If we take a long walk, or climb a steep hill, or pull a boat against stream for half an hour, we are conscious of a marked feeling of fatigue in our legs or arms, as the case may be; we have in so far unbuilt the material of our bodies, and we need repose to set them right again. But this repose does not merely mean, as we might at first sight imagine, a cessation from work; it means also an actual rebuilding of the

wasted organs. There is no reason why simple lying-by should mend a wearied muscle any more than it would mend a broken watch; there must be a positive process of renewal in the expended tissue. If, after our steep climb uphill, we sit down upon a bench at the top, and rest our weary limbs, then so long as we remain still the wasted muscles are actually undergoing a rebuilding process—they are being restored to their original condition by taking up their proper material from the blood that perpetually circulates through them. That is why, after a few minutes' rest, we are able to go on again almost as fresh as ever; the muscles are once more put into working order, and the machine is ready to begin operations again. The longer the exercise, however, the longer must be the period of rest and repair, and, after a whole day's active employment, we need a whole night's uninterrupted repose.

Still, even this consideration does not sufficiently explain why that needful rest should necessarily take the form of sleep. It might reasonably be asked, "Would not mere muscular repose do just as well? Why should we require slumber in addition to inactivity? Why might we not just put our legs up on a sofa, and read or talk the whole night through?" Everybody knows that such mere muscular rest is not sufficient; and the reason is because we have a mind as well as a body, a brain

and nervous system as well as legs and arms and muscles. After a certain length of exercise, our eyes, our ears, our tongues, and our nerves grow tired and used up — they need rest as well as our larger members. Above all, the brain itself has then grown dull and used up — all its active parts have become quite literally worked out, and require to be once more rebuilt and restored, just as the legs do after a long day's walk. Sleep, then, is essentially the time when repair predominates over waste, as in waking life waste predominates over repair. And it is more especially the time when repair takes place in the brain and the great organs connected with it. We may rest our legs or arms by lying down on a sofa; but we cannot rest our brain except by sleeping. To lie awake all night, however soft our couch, and to sleep soundly are two very different things. Lying awake, we may rest and restore our limbs, but we are not restoring our brain and nerves. At last, however, in ordinary cases, the brain ceases to work — we think no longer, we are asleep. Then the task of restoration begins apace; the blood quickly builds up the wasted organs of the various faculties, and next morning, as soon as the work of repair is completed, we wake up again fresh and vigorous.

It is clear, then, why, in most cases, night has become the time for sleep. Since the brain, even

more than any other organ, cannot go on working continuously without any time for restoration, and since the day is the easiest period for men and animals to see in as they go about their various avocations, it is natural enough that the night, "when no man can work," should be assigned as the proper season for rest and repair. Almost every kind of higher creature has accordingly adapted itself to this obvious necessity. And so ingrained therefore has this habit become of passing a long daily period in repose of the brain and nerves that even those animals which have taken to nocturnal habits, to escape their enemies or to secure their prey, merely reverse the ordinary rule, sleeping in the daytime and waking by night. In fact, though some very simple and lowly things can do without sleep almost altogether, because they only go catching food and digesting it, without eyes or thinking apparatus, no animals as high in the scale as even fish or reptiles could possibly get on without this needful period of rest and slumber. And the higher the type of life the greater the necessity for sleep. People who lead very healthy out-of-door lives, working hard with their limbs and muscles, and eating a sufficiency of good plain food, can do with comparatively few hours in bed. What they need to repair are mainly the muscles and the nerves supplied to them, as well as the eyes, the ears, and the sim-

pler portions of the brain. But people who have to study or think much, people who use their brains largely, people who have many calculations to make, people much puzzled or worried about money or business difficulties, such people require comparatively much sleep, though they often are not able to sleep nearly so soundly as their healthy outdoor-working neighbors. This is the true answer to Shakspeare's famous inquiry, "Why rather, Sleep, liest thou in smoky cribs than in the perfumed chambers of the great?" People who have not overworked their brains fall readily into a profound slumber, and rise from it refreshed and happy. But, when a man has too many mental cares and occupations, when he is distracted and worried by endless troubles, his overwrought brain gets often into a feverish, restless condition, and he cannot obtain the repose he so much needs and longs for. His brain will go on working in spite of him. Sleeplessness, in fact, is the common complaint of brain-workers; they require rest, but they cannot get it. This is a very bad state indeed to fall into, and it should be guarded against by every means possible. Narcotics and sleeping-mixtures are of extremely little use indeed, or rather they are poisons in the long run; the one real remedy is complete cessation from overwork before it is too late. Not to sleep is to wear out the brain by excessive and ceaseless activity.

Troubled or disturbed sleep is really sleep during which the brain is not entirely resting. Sometimes, in exceptional circumstances, and especially when we have been over-excited or over-stimulated in any way, the brain almost refuses to rest at all ; we fall into a state of more or less perfect insomnia ; and, even if we manage to drop off somehow for a few minutes, we are vaguely conscious all the time that the brain is still working of its own accord, so to speak, that flitting dreams are hovering about us in the midst of our imperfect slumber, and that the whirl and stir to which we have exposed ourselves now refuse to sober down at once into absolute quiet. In such circumstances the best relief is to bathe the head and brows in cold water until the feverish condition has partially subsided. This common and effectual remedy better explains than almost anything else could do the true meaning and cause of sleeplessness. The blood is circulating too freely through the brain and keeping it up to its wakeful degree of activity—such activity being indeed often in excess of ordinary excitement ; by applying cold water the sufferer drives back the abnormal flow of the circulatory fluid, and so ensures the needful rest to the overwrought nervous centres. So simple a physical remedy as this proves often far more efficacious than all the purely mental nostrums, such as repeating over

and over the same syllable, or counting the imaginary sheep which leap over a gate — processes that frequently rather increase than allay the internal irritation to which the sleeplessness is ultimately due.

VII.

HOLLY AND MISTLETOE.

IF any stranger were to ask an ordinary German child what idea or object it associates most closely with the twenty-fifth of December, the little Teuton would undoubtedly answer, "A Christmas tree." The trim and upright ever-green spruce fir, gayly lighted with red and yellow waxen tapers, and hung around with a glorious profusion of wooden dolls, toy soldiers, and tin trumpets, forms the very embodiment and central point of the Christmas festivities to the fair-haired and blue-eyed children of the northern Fatherland. If the same question were similarly put to a budding ten-year-old American citizen, the young New Englander would promptly answer, "I guess it's Santa Claus." The jovial saint who descends the chimneys of American houses while the youthful republicans are sleeping soundly, with their stockings hung expectant and open-mouthed at their little bedsides, is to them the prominent feature and main interest of the transplanted Yule-tide. But, if a group of merry, red-cheeked English children were asked in turn what

picture Christmas especially called up in their eager little minds, they would answer, we fancy, in unanimous chorus, "A big plum-pudding all on fire, with a sprig of holly-berries stuck in the very middle." Mistletoe and holly indeed, though both of them owe their connection with the great mid-winter feast to a pagan origin, have wound themselves so closely round the very core of the chief Christian English festival that we can hardly think of Christmas without instinctively thinking at the same time of those two familiar Christmas decorations. When circumstances lead an Englishman to spend the day of the Nativity in distant lands, there is nothing that he misses more or regrets more deeply than the mingled white and scarlet berries of our British Christmas-tide. It is all very well cooking a festive turkey on the sweltering plains of Jamaica and Trinidad, or making believe with plum-pudding and mince-pies in the mid-summer heat of an Australian December; the travelling Britisher turns back his inner gaze with longing glance upon the flesh-pots of Leadenhall Market, and misses among the gorgeous tropical exotics the mistletoe and holly of Covent Garden. Even in Canada, where snow without and roaring logs within seem to recall more vividly the English Christmas of the Tudor period, the visitor from the mother-country finds the green hemlock with oranges hung upon its

boughs by cunningly inserted wires but a poor substitute for the genuine old-fashioned pictorial associations of the crinkly holly-leaf and the pallid mistletoe.

The use of holly-berries for mid-winter decoration runs back, like so many other festive practices, to a positively immemorial and unknown antiquity. Long before Christmas as a Christian holiday existed at all, the Christmas decorations were hung up during the December feast-time in many an early British and Continental household. Everywhere indeed the idea of keeping high festival about the winter solstice has naturally suggested itself, quite apart from the circumstances of particular religions and races, to every branch of the human family. To say the truth, Christmas itself is not theoretically the chief holiday of the Christian year; that honor has always been accorded by ecclesiastical writers to Easter Day, the festival of the Resurrection, as the twenty-fifth of December is of the Nativity. But in practical popular estimation, especially among the little ones, Christmas holds undoubtedly the first place on the entire roll of the year's holidays. And it does so not so much because it is the feast of the Nativity as because it is the festival which happens to fall nearest to the mid-winter solstice. There is something very natural in the practice of keeping holiday in the depth of

winter, especially among simple primitive and agricultural people. The labors of the year are then suspended; the tasks of last autumn's harvest are fully completed, the tasks of next spring's sowing have not yet begun; there is an obvious breathing-space for mirth and relaxation; the tiller of the soil can then lean back in his own arm-chair, and take his ease beside his own fire-place; he has corn in his granary and malt in his brewhouse, apples in his loft, and leisure in his spirit. Moreover, the time of year itself naturally inclines one to laziness and to indoor enjoyment. Without, the fields and streets are cold and muddy; within, the fire burns bright, and the temptation to set one's feet on the fender and enjoy it idly is almost irresistible. Hence, from all time, men have made the mid-winter breathing-space a sort of excuse for a general holiday, and the practice has descended, amid all changes of guise or of religious significance, from the easy-going husbandmen of prehistoric ages to the modern work-a-day world of industrial England. The Teutonic races kept their Yule-tide, the Romans kept their wild and boisterous Saturnalia, the Celtic peoples kept their Druidical holidays, all towards the close of chill December, long before the popular feast was hallowed and re-christened by the younger and purer religion of latter-day Christendom. And even now the

French keep up New Year's Day as their great annual fête, thus showing how much more the festivities depend, as we rightly say, upon "the season" than upon the particular religious sanction.

When Christmas came, however, it inherited, as it were, from Roman Saturnalia and Druidical festival many of their old distinctive heathen ceremonies. In ancient Rome friends sent one another sprigs of holly at the mid-winter feast, as an emblem of good wishes for the coming year; and early Christians, adopting the custom, connected it with their own holiday of the Nativity, perhaps regarding the evergreen character of the plant as emblematic of the eternal life secured them by the events inaugurated on the very first of all Christmas mornings. So, too, the early Celtic races, in England and on the Continent, attached some mysterious interest to the mistletoe, and connected it with the universal mid-winter festivities; and here in Britain the connection has still survived, though the mystical virtues are almost forgotten, save in the kind of sanctuary which the mistletoe-bough affords for a certain amount of harmless flirtation not elsewhere or at other times so openly permitted. The liberty to kiss a pretty girl beneath the Christmas mistletoe lingers on, in fact, as the last faint dying relic of the extreme license of the old

pagan Saturnalia. So long as gorse is in blossom, it is true, — as the old proverb tells us, — then is kissing still in fashion; but under the mistletoe-bough it is open to all, and none may pretend to escape the light penalty. It is strange indeed to find practices so opposed in their origin still loitering on side by side; for the practical modern Christmas is, in fact, a conglomerate of many distinct forms of heathendom with a great religious Christian festival. And yet, on the whole, no happier combination of quaint old customs and pleasant memories could easily be manufactured.

The holly-tree itself, which supplies the red berries so intimately bound up with the festivities of the season, is a truly wild British evergreen shrub, a native of all southern and central Europe. Though we usually see it merely as a small and somewhat stunted bush, planted in thickest hedges, or quaintly clipped in cottage gardens with old-fashioned precision into prim shapes of cones or pyramids, it will yet grow under favorable circumstances into a tall and handsome leafy tree, some forty feet in height, with a long, smooth, whitish trunk and a spreading crest of rounded boughs and foliage. The holm-bush, as our ancestors oftener called it, thrives especially on the cold damp clays of the Surrey weald, where it gives its name to the well known expanse of Holmwood Common, a wide

and tangled thicket of well grown holly-trees. The familiar crinkled leaves, with their sharp spiny angles, are of course intended to deter the cattle from browsing on the foliage, and so hindering the proper growth of the tree to which they belong. As a general rule, all the shrubs and bushes which grow on such very open unenclosed spaces are similarly protected from the hungry attacks of cows or donkeys — for example, furze is armed with stiff thorny leaves, blackthorn with sharp prickles, dog-rose with hooked thorns, and may with smart defensive spines. To the self-same category belong also nettles, thistles, blackberry-brambles, and buckthorns. All alike need to be protected from the ceaseless depredations of browsing animals, and all gain the requisite protection by producing thorns, prickles, or stinging hairs as defensive armor. It is worth while to notice, however, that the holly, which grows far taller in favorable circumstances than any other of these well armed shrubs, puts forth, as a rule, the prickly leaves only on its lower branches, where they are openly exposed to the attacks of animals. As soon as it attains a reasonable height above the ground, the branches which rise well out of reach of the browsing enemies are covered only with smooth round blades, not at all unlike those of the common laurel. Nature gives the holly protection just so long as the tree needs

it; when it becomes no more necessary, she withdraws the murderous spines so annoying to the tender noses of cattle, and economizes the material for other and more useful purposes.

Few people, probably, ever notice the precursors of the brilliant scarlet berries, in the shape of densely clustered and delicate pale white flowers, which cover the boughs of holly, in the corners between leaf and stem, about the middle of May or beginning of June; and yet holly-blossom, when one comes to look closely into it, is in its own way an extremely dainty and beautiful flower; and the effect of the dense masses of pallid white rosettes against the glossy dark green of the waved foliage is almost as striking, when once observed, as that of the scarlet fruit a little later in the season against the self-same exquisite background of subdued verdure. Only close observers of nature, however, watch the holly in these its earlier stages, and notice how the delicate and short-lived petals fall off entire in a single piece as soon as the flowering season is over, strewing the ground below in thick profusion with a little shower of translucent witch-like blossom. Soon the berries begin slowly to swell, and in the autumn to acquire their rich red or, less often, bright yellow color. It is a common and pretty superstition among dwellers in the country that, when holly-berries are excep-

tionally abundant on the trees, a hard winter is sure to follow — the Father of nature, these children of simple faith believe, intending to send a severe season, provides beforehand an abundant supply of food-stuffs for those little pensioners of his mercy, not one of whom falls to the ground without his knowledge. Though observation hardly succeeds in bearing out this graceful fancy of the rustic mind, there can be no doubt that holly-berries do really play their part in nature as food for birds, especially during severe winters. They never fall of themselves from the trees, like casual seeds unintended for winged visitors to feed upon, but hang there for ever unless devoured and so got rid of by the little denizens of our hedges and copses. After a mild season, they may be seen blackening and withering away on the boughs in spring, as yet untouched, but never dropping; for the birds will eat them only when other food fails through stress of frost, regarding them as a last resource, like the bread and cheese of the little French princess who wondered people should starve rather than live upon that homely diet. In fact, holly-berries are specially adapted to dispersion by birds, which unconsciously aid in sowing their seeds and so assisting the plant in keeping up a fresh supply to future ages. All fruits or seeds which thus appeal to the assistance of winged allies are brightly colored, very con-

spicuous, and sweet or pulpy, while all those which would be injured by their intervention are brown or green, very little noticeable, and quite wanting in pulpy surroundings or sugary juices. Holly-berries, though harmless to the little creatures for whose use they are primarily intended, contain an acrid principle poisonous to human beings, and children have occasionally lost their lives through eating the tempting-looking but tasteless fruit in too great profusion.

The general interest in the holly-tree is so greatly confined to the employment of its berries for Christmas decorations that the world at large forgets for the most part its other numerous and valuable uses. Besides being widely planted as an ornamental tree, especially in the pretty variegated varieties known as gold and silver leaved hollies, it is grown to a considerable extent for the sake of its wood, which is hard grained and finely fibred, so as to make it a very serviceable material for turners and cabinet-makers. Neatly blacked, it does duty in place of high-priced ebony, and it is the usual stuff from which to manufacture the handles of tin tea-pots and of common cottage knives and forks. Bird-lime for snaring its winged visitors is made from the sticky matter in the bark; and even the berries themselves possess a considerable commercial value, as everybody knows who has ever seen the

vast wagon-loads which pour into London from the surrounding counties during the few weeks immediately preceding a cold Christmas.

The mystic interest of mistletoe, however, has always very far transcended the merely pictorial beauty of the scarlet holly. There is something about the very appearance of that weird and singular parasite which at once suggests to the mind the instinctive notion of uncanny mystery. The curious dead-alive green of the leathery leaves, the odd forking of the jointed branchlets, the strange translucent color of the glutinous berries, the marvellous origin and mode of growth, all conspire to give to mistletoe a first place among the mystic plants of primeval magic. Every sprig of mistletoe grows parasitically in the fork of a bough on some other tree, the English species infesting especially the apple, and after that the elm, seldom or almost never — in spite of common opinion to the contrary — the British oak-tree. The popular idea amongst townsmen that mistletoe is peculiarly apt to inhabit oaks is due, no doubt, in the main, to imperfect memories of English history learned in childhood. As a matter of fact, the mistletoe hardly ever grows on those particular trees, and it was the very rarity of an oak mistletoe that gave it its special and peculiar sanctity. The Druids — if the old story be true at all — venerated the plant just because

of its unusual habitat. To be sure, there is another kind of mistletoe in southern Europe, closely similar to our own, which does actually prefer the oak as its permanent dwelling-place; but our British plant confines itself almost entirely to the mossy branches of the common apple-tree. In the orchards of Herefordshire and the adjoining counties it covers many of the oldest boughs, and London is largely supplied with its Christmas emblems from these places. But the home supply is not, in itself, equal to the enormous demand—for what English house is without its sprig of mistletoe in the festive season?—and foreign countries have to be put under contribution, crate-loads of the parasite being annually imported from Normandy, Picardy, Holland, and Belgium. The imports are reckoned by the ton in quantity, and more than two thousand crates are needed to supply the osculatory necessities of London alone in a single season.

Mistletoe is one of the most remarkable vegetable parasites in the whole range of plant-life. The berries are sown and dispersed by the agency of birds, which eat them greedily, and in so doing get some of the sticky glutinous seeds gummed to their bills, their feet, and their feathers. Flying about from tree to tree, they rub off the seeds they have thus unconsciously transported, and leave

them clinging to the customary rubbing-places, in the forks of trees. An experienced observer has watched them performing this involuntary operation of seed-sowing many times over in a single orchard, and has afterwards noticed the gummy seeds sticking to the crannies of the bark where the birds have deposited them. In fact, the viscid character of the fruit has been acquired for this precise purpose, to enable the seeds to gain a firm footing in the place where they are by nature fitted to root themselves and thrive exceedingly. The young plant, having thus been started in life under favorable auspices, soon begins to attach itself by a thickened bulb at its base to the living tissues of the unfortunate apple-tree, and to suck from its veins the sap or life-blood which the apple had already elaborated for the use and growth of its own fruiting branches. Sending forth yellowish green succulent sprouts, with oddly arranged pairs of opposite leaves, this vegetable robber soon begins to flower, the little inconspicuous blossoms appearing in the spring of its second year, though they are so unnoticeable that few save close observers, in all probability ever detect them. The flowers are of two kinds — one barren, collected together in little bunches in the forks of the stem, the other fertile and solitary, growing out at last into the little transparent jelly-like berries. Each berry contains a

single seed enclosed in a very glutinous pulp, and ripens about the middle of December. The very word "viscid" by which we describe such sticky substances is itself derived from the Latin *viscum*, the name of the mistletoe in the tongue of the Romans. Like the holly, the berries of the mistletoe are accused of being poisonous, and deaths are even said to have occurred from eating them; but, if so, the danger must be due rather to their glutinous nature than to any active poisonous principle, none such being discoverable within the pulp of the berry. It may be taken for granted, however, that the alarming increase in infant indigestion which usually manifests itself immediately after the Christmas festivities is due rather to excessive indulgence in plum-pudding and mince-pie than to the deleterious properties of holly and mistletoe.

VIII.

KNOWLEDGE AND OPINION.

“WHAT is the use,” say many good people every day in the present age, “of these new-fangled modern scientific men? No two of them ever tell us the same thing twice running. One of them advises us to eat nothing at all but bread and vegetables; another assures us we are eternally and immutably constructed for a mixed diet of beef and mutton. Doctor No. 1 declares that cholera is due to a small creature, which he calls by some terrific name or other, three times its own length, a bacterium, or a microbe, or a bacillus (as if he wanted to frighten us); Doctor No. 2 informs us solemnly that it is due to nothing of the sort, but merely depends upon that convenient medical Jack-of-all-trades, ‘atmospheric conditions.’ Astronomer the first is profoundly convinced that the spots in the sun are electric storms on its disturbed surface; astronomer the second laughs him in the face because he ventures to assert that the red sunsets we all so much admire are ultimately dependent on the volcanic dust from the eruption of Krakatoa more than a

year ago. Whatever Mr. A. ventures to believe, Mr. B. delights in disproving. While they pretend to teach us all what we ought to think, they are always at loggerheads among themselves as to their own ideas and opinions. Does one of them set forth his profound discovery that man is descended from a primeval monkey, straightway another of them proves to demonstration, on scientific principles, that men and monkeys are separated from each other by an impassable gulf, like that which divided Dives, in his place of torment, from happy Lazarus, in Abraham's bosom. Does one of them give us, like Mr. Pickwick, a *Theory of Tittlebats, with Speculations on the Origin of the Hampstead Ponds*, forthwith another arises to show that the theory is the baseless fabric of a dream, and that the ponds were really dug out a hundred years ago by an eminent contractor for the supply of milk (of the usual quality) to the population of London. No, no; these men who presume to teach us all are really every bit as ignorant as we ourselves are. Whatever one of them says the others contradict; and, as it is impossible for us outsiders to decide when doctors disagree, or to find out which of them is in the right, the best thing for us to do is to disregard them all impartially in the lump together."

Now, on the first blush of it, this familiar complaint seems really to have a great deal of reason

in it. Our public teachers are always disagreeing among themselves, and fighting out their little differences, as Horace said actors should not kill their victims on the stage, "before the people," in the daily newspapers. But, when we come to look a little more closely into the matter, the justice of the complaint is far more apparent than real. In every science, or, in other words, in every department of knowledge, the vast body of ascertained fact far outweighs the small residue of undecided opinion. Take, for example, mathematics. It is quite certain that four times four are sixteen; it is incontestably proved that, if nine be taken from twenty, eleven remains; and it is practically undeniable that in English measurements two pints go to the quart, eight ounces equal half a pound, and thirty pence make two-and-six-pence. Take history, again. It may not be accurately settled whether Julius Cæsar landed at Deal or at Dover; whether Queen Elizabeth was really in love with Essex; or whether the Duke of Wellington at Waterloo did or did not say, "Up, Guards, and at 'em!" — but at least the Roman occupation of Britain, the main facts as to the Spanish Armada, and the historical reality of the Battle of Waterloo, are fairly beyond all cavil. There may be persons who have in all seriousness what Archbishop Whately pretended to have for a satirical reason, "Historic Doubts as

to the Existence of Napoleon Bonaparte"; but such persons, if any there be, are properly considered by Her Majesty's Commissioners in Lunacy as fit subjects for their polite inquiries. People may be ignorant of these facts — a great many people are; but they are nevertheless facts, not mere matters of opinion. Not to know them is easy enough, but seriously to doubt them is simply ridiculous. Though many estimable Chinese are doubtless unaware of the very existence of Regent Street, Regent Street is nevertheless a genuine, a solid, and a sufficiently tangible reality. Nobody who has ever been there can deny its existence, unless he is either a confirmed lunatic or a confirmed teller of untruths.

It is just the same with the vast mass of scientific knowledge. For science, as has well been said, is nothing more than ordinary experience, accurately observed and reduced to rules of precision. Everybody knows that wood burns; that iron, if exposed to damp and air, soon rusts; that meat, kept too long, goes bad; that quicklime, when wetted, steams and gets warm. Well, chemistry is only a systematic collection of similar facts about an immense number of natural and artificial bodies. Everybody knows that in cold weather water freezes; that in hot weather ice melts; that, if you stretch India-rubber, it jumps back again; that, if you put mutton-fat upon the

fire, it melts and bubbles. Well, physics is only a systematic collection of similar facts about all solids, liquids, and gases. Everybody knows that strawberries grow on a low creeping herb; that peaches and plums have always stones inside them; that if you plant a pea in the ground, a young pea-plant will shortly make its appearance; that thistledown produces a crop of thistles; and that grapes are yielded only by the vine. Well, botany is nothing more than a systematic collection of similar facts about all plants, trees, and bushes. In the same way every science consists merely of ascertained knowledge about various groups of objects, precisely the same in kind as the knowledge which every one of us possesses about our daily experiences. To say one does not believe in science is to say, in other words, one does not believe in anything, however simple and obvious. For, if you believe that fire burns your fingers, that is a fact of physical and physiological science. If you believe that fowls have always gizzards, that is a fact of anatomical science. If you believe that it will be full moon on Wednesday week, that is a fact of astronomical science. If you believe that London is in England, and that the shortest way thence to France is by Dover and Calais, those are facts of geographical science. Whether one discovers these truths for one's self, or reads them in books, or learns them

in childhood, is a matter of no importance as regards their scientific character. The children in a West Indian school have never seen a lump of ice; but they are taught that in England on cold nights water freezes, and they believe it. We ourselves have learnt it without teaching; but in either case the knowledge is equally scientific. Very few of us have been to Australia; yet we believe in the existence of that country almost or quite as firmly as if we had actually seen it.

Now, science as a whole is almost entirely made up of such perfectly well ascertained facts. Even if we cannot all follow the reasoning or the experiments by which they were reached and proved to be true, we are bound to accept them on the authority of the universal voice of those who can follow them. We all see that five and five make ten (unless we are absolutely idiotic); we can most of us see that if two things are equal to the same thing, they are also equal to one another. But not all of us can see that the square on the hypotenuse of a right-angled triangle is equal to the squares on the other two sides put together. Yet even here that is only because we fail to appreciate the force of the reasoning which proves it. There are people who cannot follow Euclid's demonstration of the matter; but there are no people who can follow it and who deny its validity. The thing is proved; it is science,

or ascertained knowledge; everybody capable of understanding it admits its truth; and those who are incapable of understanding it must take it on trust from the report of others. So, again, to put a somewhat higher instance, with the rotundity of the world. We all believe the world is round. Some of us can verify for ourselves the reasoning by which it is shown to be round; and some of us cannot. But, whether we can or whether we cannot, we are alike bound to accept it. The belief is science; it is ascertained knowledge, not matter of opinion; we cannot disbelieve it without plunging ourselves at once into all sorts of ridiculous mistakes. Every ship that sails from America to Europe, to India, to New Zealand, to the Cape of Good Hope, proceeds upon the assured assumption that the world is round, and would never get to its destination if it proved to be flat, or square, or egg-shaped, or irregular. Every kind of large undertaking upon the earth's surface takes for granted its rotundity, and succeeds only because it is really round. If you accept science, you will find yourself in the right at last; if you do not accept it, you will most assuredly find yourself in the wrong. A Chinaman may refuse to believe that London is in England, and confidently assert that it is really in France; and, as long as he remains in China, and has no practical dealings with London, his error will not greatly matter. But,

as soon as he tries to put his belief into practice, and sets out to look for London in Normandy or in Provence, he will very quickly discover his blunder, and find himself pulled up short at last by the stern logic of facts.

And this leads us on to the real test and justification of all scientific belief—its constant verification in the realities of life. An eclipse of the sun, a transit of Venus, a comet's return, is predicted confidently for such and such a day and hour. The day and the hour arrive, and there, punctually to the minute, the sun is eclipsed, the transit is observed, the comet returns. It is just the same in all other things. What is the justification of our science of physics? Why, the fact that in accordance with its laws we make steam-engines which do go, we construct microscopes which do magnify, we produce bridges and railroads and ships which do perform the work we expect of them! What is the justification of our electrical science? Why, the existence of telegraphs, telephones, electric lights, electro-plate spoons, and the thousand other practical outcomes of our knowledge of electricity! What is the justification of our chemical science? Why, the fact that we can make dynamite which will blast the most solid rocks, chloroform which will still the most poignant pain, gas which will lighten the darkest night, acids which will dissolve the

toughest metal! The whole world around us exists in virtue of the belief in science — that is to say, in ascertained fact. If we were all to refuse belief in the laws of physics, we should walk over precipices and get dashed to pieces on the ground beneath; if we were all to refuse belief in the laws of chemistry and electricity, we might go back to tallow candles and weekly posts. Why, we should not be able to have even these; for to light a candle with a match implies belief in ever so many scientific truths — that matches ignite when struck; that wicks can be set on fire by lighted matches; that candles will burn slowly and give out sensible light; and so forth *ad infinitum*.

How is it, then, that scientific men seem always to be at loggerheads with one another about the principles of their own sciences? The answer is, because their chief interest at any moment is concentrated upon what may be called the growing-point of their subject — the small part that is just passing from the stage of mere opinion or suspicion into the stage of ascertained fact. In astronomy there is a vast body of certain and fixed truths about the sun, the planets, the comets, the meteors, the fixed stars, the great cloudy, hazy masses which we call the *nebulæ*. These truths nobody doubts; and astronomers, therefore, are not greatly engaged in discussing them. They

are known, catalogued, finished, and done for. That the earth revolves round the sun in a certain known number of days, hours, minutes, and seconds; that the moon revolves in an equally known period round the earth; that Jupiter and Saturn have respectively so many satellites or attendant moons; that Neptune exercises a certain measurable influence on the orbits of the other planets, — these are facts now definitely settled once and for ever. But what is the exact constitution of the sun's body, what is the precise nature of comet's tails, how the meteors are related to the planetary system, and so forth, — these are questions still engaging the attention of astronomers, and on which different authorities are as yet liable to express different opinions. Similarly with other sciences. That bats, in spite of their wings, display immense similarity of structure to hedgehogs and shrewmice; that bamboos are only very large and woody grasses; that the brain in man is the organ of mind; that the use of the heart is to set the blood in circulation, — these are facts universally admitted. But what is the wild plant from which we derive our cultivated wheat, whether all animals are descended from a common ancestor, what is the particular function of each part of the brain, how the blood acts in building up the various nerves and muscles, — these are questions on which men of science have

not yet arrived at any definite and unanimous agreement. The fact that any question is still undecided makes us hear a great deal more about it than about the fifty thousand points that are finally fixed. But that is no reason for charging men of science with inconsistency and dogmatism; it is merely a reason for waiting to accept either opinion until it has stood the test of time.

IX.

THE WINTER REST.

ONCE more the wild life of the North has sunk to sleep in field and woodland for its long annual siesta; for what night is to man and other animals, viewed individually, that is winter to universal nature in its collective aspect. It is the period of rest, of repose, of calm, of dormancy. Though we notice this great annual sleep of the world most of all in the vegetable kingdom, it extends almost equally, when we come to look a little closer, to the vast mass of animal life as well. To be sure, the larger animals, which alone most of us ever observe with any minute attention, such as horses, donkeys, sheep, and cattle, remain quite as wide awake during the winter months as in the balmiest height of summer; but it is far otherwise with the immensely larger number of our native small beasts, reptiles, amphibians, and insects. All of them take their winter nap with great regularity. The dormouse retires to his hidden lair at touch of the first frost, and there sleeps away quietly the whole chilly season. The squirrel goes into winter quarters in his com-

fortable nest, and wakes up only at long intervals, on exceptionally sunny days, to visit the hoard of nuts and acorns which he has laid by in a convenient hollow at some little distance from his own deep-dug home. The mole takes refuge in his fortified castle, with its regular defences of tunnel and gallery, where this otherwise voracious animal spends in sleep two or three months of almost complete fast, while, at ordinary times, a few hours without food would be quite sufficient to starve him utterly. The hedgehog dozes away the entire winter in a deep and warm bedchamber carefully lined with leaves and moss. The more bulky badger hibernates in a rather less complete fashion, snoozing for a fortnight or so during the heaviest frosts, and then taking an occasional nocturnal stroll, on the lookout for stray birds or rabbits, whenever a short spell of open weather permits such little intermediate excursions. The harvest-mouse, again, has no fixed principle in the matter of a long winter siesta; if he happens to find himself in comfortable quarters in a warm barn, he repays the hospitable farmer evil for good by keeping awake through the whole season, and devouring the corn with active assiduity; but, if he discovers himself stranded by chance in the frozen fields, he retreats to his little burrow for protection from the weather, and there indulges in a long and sound nap till spring is back again.

The creatures which subsist exclusively or mainly upon small guats and other flying insects are of course those upon which the winter rest tells most unfavorably. The swallows and martins indeed, whose beautiful, curved flight, open-mouthed, over the ponds and fields where such insects abound is one of the most charming sights of summer, evade the difficulty by retiring to some of the now fashionable winter stations in Georgia and the Gulf, on the Riviera or in Andalusia, and Algeria, where they may hawk to their hearts' content after flies and mosquitoes the whole winter through. But the less fortunate bats have never learned, or inherited from their ancestors, this convenient device of migration; and they are consequently compelled to hide in the roofs of houses, the steeples of churches, and the crevices of rocks, as soon as the midges have disappeared for the season, and there to sleep away the foodless period in a state of complete torpidity. Lack of food, in short, is everywhere the great cause of the winter torpor. For example, hibernation is comparatively very rare among birds, but the owl may almost be said to hibernate, for during the chilliest months, when shrews, field-mice, water-rats, and voles — its favorite prey — are all laid up in their various winter beds, it often goes for weeks together without provender, and seems then to doze away the time in a practically dormant and

drowsy condition. As to the reptiles, the common tortoises, sold about the streets of London on hand-barrows, and imported chiefly from Greece or the Levant, bury themselves deep in the ground as autumn approaches, and only reappear in spring when the juicy plants on which they feed are once more pushing up their tender seedlings. Of course the idea that they eat slugs and cockroaches, so sedulously encouraged by their itinerant venders, is but a playful myth; for in reality the tortoise is as confirmed a vegetarian as Professor Newman himself in person. The common newt also remains torpid in winter at the bottom of ponds and ditches, as the lizard, the adder, the snake, and the blindworm likewise do in their sandy burrows.

Thus it will be seen that a large part of the animal life of cold countries in general remains entirely suspended for a considerable period of the year, all the creatures belonging to the above species and to many others which we have not enumerated being all at once sound asleep for weeks together. The teeming woods and heaths and uplands, which in summer abound everywhere with the manifold signs and sounds of life, are then silent, motionless, and abandoned. But still more curious is the fact that many kinds of insects have their whole specific life interrupted, as it were, by the advent of winter, the entire race

dying down in the last days of autumn, and being represented until the next spring, not by living members, but by eggs alone. There is something very singular, and we might almost say marvellous, in this idea of a whole race lying dormant, so to speak, in the egg condition for months together, while not a single representative of the race survives personally to carry on its conscious life and traditions through the intervening period. In the spring the new generation is hatched out from the egg, without ever having seen a solitary individual of the earlier broods; so that each year's crop lives in entire ignorance of its predecessors and successors, having come, as if by miracle, it knows not whence, and leaving its eggs carefully hidden after it, it knows not why or wherefore. In many insects, however, a few individuals manage to drag on their lives by hibernation from one season to another, and thus keep up uninterrupted the succession of the race. This is the case with lady-birds, some of which always live through the winter; as also with wasps, each nest of which is produced by a single female who has passed the colder months in a state of torpor, concealed in moss or some other secure retreat. Humble-bees similarly derive their origin from a hibernating female, known as the foundress, who has in like manner slept through the winter in a hollow tree. With certain other insects it is the

larvæ in their cocoons that slumber peacefully through the inclement season, emerging in the full-winged state as soon as the warm weather has fairly set in again. As for snails and other mollusks, they close the mouths of their shells with a slimy wall or partition, creep into crannies of rock or holes in walls, and spend a drowsy Christmas after their own fashion in uninterrupted somnolence. Altogether it would probably be not far from the truth if we were to estimate that from November to March nine-tenths of the species of animals, great and small, indigenous to New England or to the British Islands are all comfortably asleep together, either in the adult form, the egg, or the chrysalis. In every case, when animals are hibernating, the action of the heart and lungs almost ceases, and the small amount of vital activity that still remains is carried on at the expense of the stored-up material already laid by in the creature's own body. Hence they usually go to sleep extremely fat, and wake up again the succeeding year lean, skinny, and voraciously hungry.

Plants go through stages exactly analogous in all these respects to those undergone by animals. Certain annuals, the equivalents of the plant-lice and other insects which survive through the winter in the egg form alone, sow their seeds in early autumn, and die out entirely themselves during

the December snows. This is especially the case in very cold countries, and is true even of Canada, of the north of Scotland, and of the Yorkshire moors. In such cases the life of the species is altogether interrupted for some months at a time, during which period the entire race has nothing to vouch for it save a number of dried and scattered seeds. As a living kind it has ceased for the moment to exist at all, except potentially. But in England and in Northern America most wild annuals shed their seeds in summer or early autumn; and the seedlings immediately spring up with the first rains, and struggle through the winter as best they may with great persistence. Of course the frost cuts off a great many; but a great many more still survive, and these latter amply suffice to carry on the life of the various herbs into the next season. Perennials, on the other hand, may be said for the most part to hibernate and remain torpid just as truly as the dormouse and the garden snail. Nay, they even fatten themselves, as it were, against the cold season. During the whole summer, the leaves, which are the true mouths and stomachs of the plant, are busy every day and all day long laying up starches and other valuable food-stuffs, under the benign influence of the bountiful sunshine. But, as autumn approaches, the plants withdraw the useful material from the leaves, now about to fall,

and store it up in the permanent tissues, either in bulbs, roots, tubers, stem, or green bark in the fresh saplings. It is this withdrawal from the foliage of the living green matter, together with the important protoplasm and other vital principles, that causes the beautiful tints of autumn. The ordinary pigment being drawn off, other coloring matters, till then unseen, or produced by chemical changes connected with the withdrawal, come at once into full prominence. If the vital principles remained in the leaves through the winter, they would be killed by the cold; but by being stored up in bulbs, or roots, or stems, they pass safely through the frosty ordeal. In the case of some few plants, however, such as laurel, holly, pines, and yew-trees, which are evergreen, even in our own climate, the leaves are very tough and leathery, and are usually extremely glossy, the gloss being due to a layer of transparent, empty cells, which, as it were, glaze the leaf, and protect it from cold as glass protects a hothouse. Such plants may be looked upon as the vegetable equivalents of robins, sparrows, hares, and foxes, which manage to keep alive and fairly wakeful the whole year round. On the other hand, the numerous class of bulbous plants, of which only the buried bulbs or tubers remain in winter, deeply hidden underground, may be compared exactly with the tortoise, the mole, the adder, and the

hedgehog, which similarly retire for the sake of warmth far beneath the soil.

This practice of the winter sleep of plants and animals, however, though now so familiar to all of us in northern climates, is, geologically speaking, a comparatively modern and recent habit. During by far the greater part of this planet's existence winter has been absolutely unknown over its whole surface, from the poles to the equator; and tropical vegetation, with a tropical fauna, reigned supreme even within the Arctic Circle. It was only at the very close of what geologists call the Tertiary Period that any indications of chilling at the extreme north and south ends of this oblate spheroid of ours began to display themselves, and winter and summer first took their present form. Up to that epoch, therefore, all the trees on the earth had been evergreens, as they still are within the tropics, mostly of the large-leaved type represented now in our own shrubberies by the laurels, the laurustines, and the Japanese aucubas. But with the setting in of that long cold spell, known as the Glacial Epoch or the Great Ice Age, all this was rapidly reversed. Plants and animals alike, finding themselves face to face with hitherto unknown chilly conditions, had either to accommodate themselves to the new circumstances or to die out altogether. Many kinds among them, it seems, were unable to

modify their structure or habits so far as to meet the changed state of things; and therefore not a few giants of the previous age, such as the mammoth, the mastodon, the cave-bear, and the sabretoothed lion, died out utterly, leaving no descendants. But a considerable number showed sufficient plasticity of nature to survive into the newer and colder era. It was as though one should gradually pull down the walls of a hothouse, and extinguish the fires, leaving the few stronger kinds among its inmates to struggle on as best they might in the cold, while the remainder perished miserably. The trees and shrubs for the most part accepted the new *régime* by becoming deciduous, shedding their leaves annually at the approach of winter; though a few creepers and bushes, like ivy, holly, and box, secured themselves rather from the January frosts by the adoption of smooth and glossy foliage. Then for the first time did the woods begin to display their autumn glories of gold and crimson, and the ground to be thickly covered in November weather by the beautiful coating of russet-brown leaves. As for the animals, they provided variously for the altered circumstances. The birds, to whom seas, straits, and rivers are no obstacles, saved themselves in great part by migrating southward during the worst rigors of winter; while the four-footed beasts, unable thus to annihilate geograph-

ical conditions, had to content themselves with burrowing in the earth, or making themselves warm nests of moss and hay, where they now lie torpid during the foodless season. As for the insects, they were fain to leave their eggs only to represent them in the December snows, or else to struggle on somehow in the chrysalis, or even in the winged condition, through the hard weather. Thus it was, modern science tells us, that the great winter sleep of universal nature in extreme northern or southern climates first began to come into existence.

X.

MOUNTAINS.

It is curious to note how much the taste and liking for mountain scenery and mountain-climbing are a mere growth of the last hundred years or less, utterly unknown not only to our practical medieval ancestors, but even to our recent domestic predecessors of the eighteenth century. The early settlers in America never descanted on the beauty of the scenery. To the contemporaries of Johnson, Goldsmith, and Burke, mountains were seldom envisaged as beautiful, picturesque, attractive, or inviting; they were always spoken of only as rugged, frowning, terrible, and forbidding. It was the toils and dangers of mountain travelling, not its pleasures and delights, that the eighteenth century most vividly realized. When sturdy old Sam Johnson himself consented for a while to desert his beloved Fleet Street and go on an exploring expedition among the unknown wilds of the Western Hebrides, his diary is full of the fatigues and horrors of Scotch locomotion, but hardly breathed a single word of the beauties

and surprises of Scotch scenery. Nay, even little hills that seem to us nowadays perfectly contemptible in their insignificance, roused the profoundest alarm and dismay in the susceptible bosoms of our great-grandfathers. When the poet Cowper, accustomed only to the gentle and monotonous undulations of the eastern counties, first made a pleasure journey through the hills of Surrey, he noted with positive terror and bodily fear the vast heights of the North Downs and the Forest Ridge, though he takes care also to express his profound admiration of that brave woman, Mrs. Unwin, who could mount them all (in a comfortable carriage on the King's high-road) absolutely undaunted. To us, at the present day, the little elevations of Leith Hill and Crowborough Beacon, which seemed to Cowper positively appalling in their height and sublimity, appear nothing more than pleasant goals for a short picnicking excursion for the afternoon pedestrian fresh out from London.

It was just the same with other people far less nervous and timid than the poet of Olney; all his contemporaries shared with him this singular and to us incomprehensible dread and equally singular and incomprehensible admiration of any height greater than that of a good-sized ordinary mole-hill. Gilbert White, a true lover of nature, if ever there was one, speaks most naïvely of the

little down that stands behind his famous parish of Selborne as "a vast hill of chalk, rising three hundred feet above the village." Another minor undulation in the same neighborhood he gravely describes as "a noble promontory," while the prospect from its summit is bounded, he says, in all seriousness, "by the vast range of mountains called the Sussex Downs." We should hardly use such language nowadays of the Maritime Alps or the Bernese Oberland; we should think the description applied fitly only to the very greatest backbones of continents, like the Himalayas, the Andes, and the Rocky Mountains. "Though I have now travelled the Sussex Downs upwards of thirty years," says White, on another occasion, "yet I still investigate that chain of majestic mountains with fresh admiration year by year." He could not have spoken with more enthusiasm if he had been trying to describe the Yosemite Valley or the snow-clad summits of the frosty Caucasus.

When the eighteenth century got amongst anything worthy to be considered as anywhere near real mountains, its helplessness and fear of the perils before it became almost childish. We hardly nowadays apply the name of mountain at all to Snowdon or Cader Idris: we speak of them patronizingly in our modern fashion as "the Welsh hills," and walk up them casually before breakfast

for the sake of the sunrise. But to the wayfarers in the reign of good Queen Anne and of the early Georges, they were veritable bugbears, huge rearing masses of solid rock, almost impassable on foot or horseback, and dreaded infinitely more by passengers to Ireland *via* Holyhead than the most difficult and dangerous of the Alpine passes are dreaded by the adventurous ladies of our own time. Thousands of tourists now enjoy themselves annually on the green slopes of Penmaenmawr, a smiling hill dotted over with villas and pleasant lodging-houses for the temporary reception of the jaded townsman on his summer holiday. But a hundred years ago Penmaenmawr was "a vast, gloomy rock," "a stupendous obstruction thrown in the way of the adventurous traveller," "a truly terrific and dangerous defile, which frights the passer-by with its almost perpendicular front of solid limestone." The little wayside inns at the two extremities of the much-dreaded road which ran across the "terrific" hill from Conway to Bangor bore two inscriptions well fitted to meet the frame of mind of the trembling ladies and gentlemen who here exchanged their roomy travelling-carriages for hired saddle-horses. On the one nearest Chester the signboard displayed the not very encouraging couplet:—

Before you venture hence to pass
Take a good refreshing glass;

while its sister board at the other end of the "truly formidable cliff" bore the congratulatory remark:—

Now you're over, take another
Your drooping spirits to recover !

which, if it is not very good rhyme, is, at least, good evidence of the fear felt by our easy-going ancestors for so slight a hill as Penmaenmawr, only fifteen hundred feet above the sea-level, and easily walked up by any ordinary modern pedestrian in any direction.

The same childish dread of mountains or big hills crops up everywhere in the books and letters of all periods up to the very beginning of the present century. Have we, then, become exceptionally brave, or were our predecessors all remarkable cowards? Probably neither. The fact is that our modern familiarity with mountain-climbing, or, at least, with hills and downs, has resulted partly from the increased ease of locomotion, and partly from the growing sense of the absolute necessity for physical exercise on the part of the dwellers in great cities. A hundred years ago most Englishmen lived and died in the towns or villages where they were born or bred. They seldom went away from home at all; or, if they travelled, it was mostly by the coach-road to London, through the very flattest and easiest parts

of the whole country. When they walked, it was in parks or gardens, or in the field-paths and riverside meadows that surrounded their own quiet native borough. Now, England, though prettily diversified, is, on the whole, a distinctly flat, or, rather, little elevated country. There are hill and dale, down and valley, heath and moorland, copse and common, it is true, to an extent not often to be found combined in so comparatively small and limited an area in any other country. But in the greater part of the kingdom there are no hills of any considerable height, and the few exceptions, as in the case of Exmoor, Dartmoor, the Peak of Derbyshire, the Yorkshire moors, and the Westmoreland and Cumberland Lake District, occur in what were then remote and almost uninhabited parts of the country, far removed from the busy centres of urban life during the Tudor, Stuart, and Hanoverian periods. On the other hand, the large towns and thickly populated districts of England lie, for the most part, along the river valleys or in the great central upland level.¹ Hence, to the Englishman of a hundred years ago, high hills or mountains were very unfamiliar and almost uncanny objects. He knew nothing about them, he had never seen them, and so, of course, had not contracted a personal taste for them as elements in scenery; and when he came across them, he was mostly concerned with the momen-

tous question how he was ever to get over safely to the other side, not with the consideration of the view from the summit. Richmond Hill and Cooper's Hill, Greenwich and Hampstead, the little heights that overhang the river, he could indeed understand and appreciate; but Snowdon and Helvellyn, Cader Idris and Snaefell, the Grampians and the Cheviots, were to him but huge obstacles thrown in his path by inconsiderate Nature out of pure vexatiousness. As to the Alps and the Apennines, which he sometimes encountered on his grand tour, he regarded them merely as masses of inhospitable snow stuck of malice prepense across the direct highway to Rome and Naples on purpose to obstruct his way south in his own respectable badly hung travelling-carriage.

Railways have probably had more to do than anything else with the singular alteration which has taken place in the public mind with regard to mountain scenery and mountain-climbing. They have made what used to be the bugbear of the rich into the pleasure and pastime of all classes. More English people probably visit Switzerland in a single year at the present time than visited the Welsh hills or the Lake District in any consecutive ten years of the last century. From our childhood upward we are made familiar with hills and with mountain-climbing; and we are gradually

broken in to it by successive experiences, beginning perhaps with the half-holiday picnicking places among the downs of Surrey or the big beeches of Epping Forest, and going on progressively through the ascending scale of Welsh, Scotch, and Irish mountains, till at last we reach the dignity of the Alps, and plant our alpenstock in proud contentment upon the virgin snows of the Jungfrau or the Matterhorn. But what is still more remarkable is the fact that a genuine and deep-seated love for hilly scenery has grown up amongst all our people side by side with this rapid development of the mountaineering instinct. We are not all good pedestrians, but we all admire and love mountain country. To the eighteenth century mountains were simply objects of terror and aversion. One may read almost all through the descriptions of travellers in wild regions up to the beginning of our own era, and hardly find a single epithet bestowed upon mountains save "horrid," "rugged," "terrific," "gigantic," "enormous," "gloomy," "stupendous," and "inhospitable." We can scarcely ever light upon a single word implying that the mountain was looked upon as beautiful, or as anything else, in fact, except a mere barrier in the way of progress. Doctor Johnson thought the finest view in Scotland was far inferior to the streets of London.

But the iron road, which has tunnelled its way

through the St. Gothard and the Mont Cenis, which has surmounted the Rocky Mountains and the Sierra Nevada, which has annihilated the Pyrenees, and begins now to pierce even the unbroken ridge of the Alps, — the iron road has laid open to us everywhere the mountain valleys, at the same time that it has made us forget the obstacles to locomotion once flung so widely by the hand of Nature across the face of the great continents. Everybody now has seen, if not mountains, at least considerable hills and eminences, and has learnt to look upon them no longer as merely rough and forbidding, but as reservoirs of fresh air for poisoned lungs, and pure stretches of untrodden turf for feet wearied with the hard and cramping pavement of cities. Scotland has become the playground of Britain, while Switzerland has developed into the playground of Europe. Instead of the very name “mountain” conjuring up before our minds nothing but pictures of danger and discomfort, it now conjures up before us endless ideas of healthy enjoyment — of delightful scrambles among rock and heather, of glorious and expansive views over lake and lowland, of breezy picnics among solitary summits, of rare flowers and beautiful ferns that cling lovingly to the weathered crannies of their native rocks. The eighteenth century did not greatly love walking; it preferred to drive in its own chariot, or to stick

at home by its own fireside. Our healthier age demands by choice a more open-air existence,—at least when possible,—and makes light of labors which to the lazy limbs of our inactive ancestors would have seemed but little if at all preferable to three weeks on the prison treadmill. The love for hill-climbing is one of the best features of our own time, and it is a love that is gradually spreading among all classes of our population. And since the bell of the bicycle has been heard in the land, the taste for hilly scenery has gone down to thousands and thousands of our young men to whom even the light fares of the cheap excursion-trains were before fixed at practically prohibitive prices. Anything that so brings large bodies of our population into closer intercourse with all that is grandest and loveliest in nature is in itself an immense boon to the whole of humanity; and in nothing has the increased ease of locomotion been more productive of good than in thus enabling us all individually to see in mountains, no longer a mere barrier to be surmounted, but a source of health and strength and æsthetic pleasure, a thing of beauty and a joy forever.

XI.

HOME-LIFE.

IT has often been pointed out by English-speaking writers that there is no word more specially distinctive of the English and American temperament than the word "home." In French, as we have frequently been told, there is no such word — an Englishman, on either side of the Atlantic, could never conceivably get on without it. And in the main we do not doubt that this peculiarly English characteristic, this touching love of home and of the home-life, this beautiful clinging to the Teutonic ideal of the family hearth, this cherished memory through life of the domestic circle, has been productive of much lasting good and real happiness to the British peoples. We may not perhaps be quite so vastly superior to other nations as we are fond in our innocent self-esteem of taking for granted silently,— it may not really be so "greatly to our credit" (as Mr. Gilbert says) that we still remain Englishmen and Americans,— but whatever good points do actually exist in the national temperament are no doubt largely traceable to the extreme strength of the family feeling

throughout the length and breadth of Britain and the States. No other nation, probably, except the German, has anything like the same respect and love for home as ours have. It is to us something sacred, holy, almost invested with a religious significance ; and anything that strikes at the sanctity of home is to most Englishmen an utter abomination. That this should be so is, on the whole, we do not hesitate to believe, a great good to our national existence.

Still, no thoughtful observer can have failed to notice of late years a growing sense of the narrowness of home in a great many of our bigger overgrown cities. Young men and young women in particular are beginning to chafe somewhat at the increasing monotony and dulness of much middle-class home-life. Not indeed that home, as home, is becoming any the less a sacred ideal with them, — let us hope that that peculiarly deep Teutonic feeling in its best forms may never lose its strength among us, — but, as homes in our great cities have grown to be something other than they once were, a certain recognition of a social want outside the home has developed slowly and half unconsciously in the minds of many among our young people. Some of them are discontented and unhappy, they do not exactly know why ; but in reality because the deeply seated social feelings of humanity find no sufficient outlet for themselves beyond the small

and now ever-narrowing range of the family circle. The fact is, our life is undergoing a rapid transformation from the life of a mainly rural and agricultural world, composed almost entirely of villages and small towns, to the life of a mainly urban and industrial world, composed for the most part of great bustling manufacturing cities, where thousand of families, unknown to one another, live huddled together into a small space, with few interests or feelings in common, and with little social intercourse with one another. In short, we have not yet adapted our habits and manners to this new social state — we have found no way of combining the arrangements of a great city with the natural and easy social intercourse of our small outlying towns and villages. Everybody knows that the practical isolation of many middle-class families in London, or Boston, or Chicago is far greater than the practical isolation of a solitary shepherd on a Devonshire sheep-walk, or of a New Hampshire farmer on a snow-clad hill-side. Most London families know nothing at all of their next-door neighbors, and many of them know hardly anybody outside their own household among the whole four million inhabitants of that vast modern human ant-hill. The solitude of the crowd is even more conspicuous and more surprising than the solitude of the desert.

How has this curious state of things come about,

and how is it to be remedied? The cause at least, if not the cure, is easy enough for any one to perceive. The aboriginal England, the merry England of other days, the England from which our Puritan ancestors emigrated, the actual England of the unsophisticated agricultural counties, consisted or consists of small settlements, each clustered round its ancient manor-house and ivy-clad parish church, and inhabited by families all of whom were born and will die upon the same spot. In such a state of society, everybody, of course, knows everybody. There are few set parties or clubs or meetings, it is true; but there is a constant natural stream of social intercourse from morning to night, from year's end to year's end, from birth to death. As every man, boy, girl, and woman walk down the little village street, everybody they meet on their way has a ready smile and a nod of recognition with which to greet them. Baker Brown and Gardener Gee—as they still pleasantly call one another in more than one old-fashioned country-town that we know of—stop continually to chat with Grocer Smith and Fiddler Jenkins, as they move about their every-day avocations. Neighbors drop in, as they themselves naïvely put it, “quite promiscuous like”; and, if they stop to tea or supper, no further preparation is considered necessary for their entertainment than an extra spoonful “for the good of the pot,”

or an additional piece of the best blue cheese on the biggest platter. Over-civilized dwellers in towns may smile as they please at these simple unpremeditated rustic hospitalities; but the countryman does not smile; he laughs loudly — and he laughs on the right side of the mouth into the bargain. Social life such as this is the kind of life to which all of us are naturally adapted. High or low, rich or poor, gentle or simple, our ancestors have all accommodated themselves to it for many generations; and each of us nowadays is born with instincts and feelings implanted in his bosom in full harmony with such an extended human environment. Man, in fact, as we all so often say, is a social animal. More than that—he is a gregarious animal. He loves the frequent society of his kind. Innate within him are deep-seated instincts—nay, nerves and brain-elements—answering physically to the ancestral habit of sociability. If these instincts are not gratified, if those special nerve-fibres are not duly exercised, there results naturally a feeling of dissatisfaction and disappointment. Just as a dog is born with the intense need for man as his master, so man is born with the intense need for the companionship of his fellows. And just as the masterless dog wanders about disconsolate and utterly miserable, so man, deprived of natural society, feels the inmost wants of his nature in so far thwarted and unsatisfied.

Now, in our domestic life, till very lately, there was ample room for the satisfaction of these profound social instincts. But the rapid growth and development of our great cities have largely upset the primitive sociability of our lives. People from all parts of the country and all countries of the world have crowded into the big towns. There they have come together quite accidentally, in streetful after streetful of miscellaneous humanity, knowing nothing of one another, often with few or no interests in common, and unable to mix freely in social intercourse. It is largely this haphazard crowding together of people from everywhere that has begotten that exclusiveness and that "stand-off" attitude which many foreigners find so characteristic of the English and still more of the American nation. Everybody is afraid of knowing his neighbor, for fear his neighbor, about whose antecedents he is absolutely ignorant, should not turn out to be quite the sort of person with whom he would naturally wish to associate. That eminently respectable man Brown is anxious to keep Smith at a distance, for fear Smith should prove an undesirable acquaintance; that eminently respectable man Smith looks askance when he meets Brown on the doorstep, for fear Brown should be discovered, upon nearer view, to be no better than he ought to be. Then, again, it is so hard for the people who would really wish to know

one another to find out their natural fellows in London or Liverpool, Manchester or Glasgow, New York or San Francisco. "Where do all the other people live whom I should like to know?" asks a despondent man of letters into whose soul the iron of suburban life has entered deeply. "In the other suburbs. Where are all the men whose tastes and habits are similar to my own? In the other suburbs." The fact is, we do not discover each other readily in these vast and unwieldy heterogeneous concourses of fortuitous social atoms.

The natural consequence of such social isolation in the big towns is that the innumerable warm human hearts of a great class, or rather of many great classes, among us have been wholly and somewhat unwholesomely turned inward on the home alone. Home, which ought rightly to fill the larger part of life, but a part only, has been made improperly to do duty for the whole gamut of our feelings as far as possible. The wealthier classes indeed have always been able to secure abundant social intercourse. They have their clubs and their assembly-rooms, their dinners and their dances, their lawn-tennis and their garden-parties, their endless occasions and opportunities for meeting and mixing with one another. But to large classes of the town populations such occasions and opportunities come seldom or never. Home

absorbs the whole attention. Not only is this excessive concentration on the family life an evil in itself and a source of unhappiness to young people, but it is also, in the long run, productive of serious mental troubles, hysteria, and even insanity. Madness, as Doctor Maudsley, the great alienist, has admirably pointed out, is essentially a disease of the social faculties. Man is and ought to be a social being; but, when proper social intercourse is for any cause denied him, when he is debarred from due intermixture with his own kind, when his mind is turned in entirely upon itself, the balance of his faculties is soon upset, and insanity supervenes. Everybody knows that solitary confinement very frequently ends in madness. Just in the same way, though of course to a less degree, intense restriction to the narrow limits of the house and the household, too great concentration of the ideas and interests on the family alone, help in the end to fill our lunatic asylums with what one may fairly call manufactured madmen. A free, expansive, natural intercourse with men and women, wide interests in politics, literature, science, art, a taste for outdoor exercise, games, rowing, bicycling,—these are the best safeguards against such evil results of our painful national overcrowding.

But how is the remedy to be practically applied? That is indeed the central *cruz* and grand difficulty

of the whole question ! Perhaps the only feasible way is by a more general understanding on the part of heads of families of the supreme necessity for harmless and healthful social intercourse. It has perhaps been too much the habit in many Puritan households to look with disfavor upon every form of social relaxation, however innocent or desirable in itself. Our somewhat austere national life, undoubtedly on the whole a great element in the strength of the country, does little harm and much good in country places ; but, when brought to bear too hardly upon the artificial conditions of our great towns, it often results in an almost total negation of all pleasures and all social meetings of every sort for young people. It is unhappily the fact that many of the means actually provided for the amusement of our population generally are open to serious objection on the score of their moral tendency. After all, our masses, viewed in the mass, have very little choice except the saloon and the music-hall. What is really needed, therefore, is that heads of families and persons in authority generally should recognize more fully the existing need for wholesome and harmless social amusements. It is possible for people to get rid of that essentially mistaken and unhealthy feeling that there is something positively wrong in the lively meeting together of young and old ; and, if we could only once banish

that baneful lingering relic of an excessive asceticism, fathers and mothers would rather try to bring about occasions for a healthy, varied, and frequent intercourse between friends and neighbors. What is wanted is not merely that young men and young girls should see much of one another in the way of courtship and marriage — that is a minor matter which always arranges itself somehow with marvellous dexterity even in the crowded jarring world of our great cities. The real need is a need for seeing more of one another generally, mixing more in each other's society, letting mind rub constantly against mind, promoting the free interchange of ideas, and, above all, gratifying those deep-seated instincts of sociability which are implanted by nature in the heart of man for good and sufficient reason, and which can never be neglected by any of us with safety or impunity. The family, we repeat, is and ought to be a great deal; but it is not and it ought not to be absolutely everything. If people make it everything, if they move always in its narrow grooves, if they refuse to stir outside it and to saturate themselves, as it were, with the thoughts and feelings and interests of others, they will pay the penalty in the long run by incurring insanity for themselves or their children and descendants. Wider sympathies are both right and wholesome. Charity begins at home; but it does

not end there. To concentrate all one's ideas and all one's affections on the family alone is, after all, only a more refined form of selfishness ; and, like all other forms of selfishness, it inevitably brings its own punishment in due time after it.

XII.

THE BALANCE OF NATURE.

THERE is no beast more thrifty and hardy than the common goat; and yet, Sir Joseph Hooker tells us, harmless and idyllic animal as it seems, it has probably occasioned far greater ruin and desolation in the world than war and pestilence put together. At first sight this seems a very hard saying, though, when we come to look closely into its grounds and true meaning, it is one of the most remarkable observations ever made upon the occult influences perpetually working unseen in the balanced and nicely adjusted economy of nature. For the goat has destroyed whole regions of forest-land, and altered for the worse the once genial climate of extensive districts. It is the habit of sheep, gazelles, and most antelopes to browse upon grass and other low succulent herbage which springs again as quickly as it is grazed down. But the goat, essentially a mountain animal, accustomed to rocky hillsides, where soft turf and greensward are quite unknown, feeds naturally upon the dry leaves of the shrubs and bushes that spring among the crannies of its native crags.

When introduced into a wooded region, therefore, the goat of course runs riot forthwith among the young trees and tender saplings on the slopes and terraces, and, multiplying rapidly, soon eats down the growth of underbrush in the forest district. As fast as the acorns or beechnuts send up fresh suckers of oak or beech, the hungry kids nibble them down to the very ground; and thus, unless strong wire ring fences are made to protect the copses, the forest is unable naturally to reproduce itself by the gradual growth of young trees to replace their elders. In time the older trunks decay and die, and then the hillsides, once covered with luscious breadth of shade and foliage, are left naked, exposed, and shadeless.

Nor is that all. The roots of the trees, extending into the soil, used to bind the earth firmly together, and prevent it from being washed away by the winter rains. But in mountain countries it is a common observation that only wooded hills are crowned with earth and verdure to the top; the woodless ones soon have their soil carried off by storm, and shower, and breeze, and torrent, which leave their bare and craggy summits deeply weather-beaten by the wind and rain. Once more, such dry and arid hills soon lose much of their power of attracting clouds and causing them to discharge their fertilizing flood. Trees are the great collectors of moisture; a damp soil, shaded

by foliage, is necessary in order to keep up the due amount of evaporation and subsequent rainfall, and the craggy peaks, left bare by goats of their rising forests, cease to perform their original function of rain-condensers for the surrounding country. In this way, it is believed, many hilly parts of Asia Minor, South Italy, India, and North Africa have been denuded of their primitive forests, and have had their climate rendered seriously arid by the mere introduction of the common goat. And yet what a simple and harmless thing it seems to turn out a few dozen goats, wild, upon a wooded hillside! Who would ever imagine beforehand that by so doing he was bringing the desolation of the sandy desert upon a once happy and smiling landscape?

It is always so in nature, up and down. The world around us is a vast interlacing whole, a complex system of innumerable parts, each of which dovetails so neatly into the next that it is impossible to alter one of the pieces in the least degree without upsetting the harmony of the whole surrounding and adjacent portions. For example, how little connection there appears to be, on a rough glance, between the number of cats in a given district and the fertility of cloverseed in the same place! And yet, as Mr. Darwin has pointed out, a very close and intimate relation really exists between the two unlike facts.

Clover always produces most seed in the neighborhood of towns, where cats are abundant. And the reason is simply this. The clover-blossom has a very long tube, concealing its honey; and the honey can be reached by only one insect, the humble-bee, which has a proboscis long enough for the purpose. Hence only humble-bees fertilize the clover, carrying the pollen from one blossom to another on their hairy legs. Accordingly, the more bees, the more clover-seed in any particular meadow. But humble-bees themselves are largely kept down in number by field-mice and harvest-mice, which feed upon them and thin their nests with great voracity. Here we get another link in the chain — the more field-mice, the fewer humble-bees, and therefore in the end the less clover-seed. Once more, cats eat rats and mice, and among the fields in the neighborhood of towns harvest-mice are far less numerous than elsewhere, owing to the depredations of their feline enemies. The more cats, the fewer field-mice, the more humble-bees, and so finally the more clover-seed! Professor Huxley has even pushed the chain of causation in this case one link farther back, and ventured to add that the setting of the clover-pods was ultimately influenced by the number of old maids in the adjacent towns; for are not old maids in the last resort the great cat-keepers? Thus we might almost say, if

we chose to pursue the matter to the very bottom, that matrimony is injurious to the interests of the clover-crop. This may indeed, in the Shakspearian phrase, be to inquire too curiously ; and yet who does not know the converse and equally singular fact that the number of marriages in England every year varies regularly with the price of corn ? Whatever makes bread cheap encourages a certain number of hesitating young people to marry off-hand ; whatever makes it dear decides a few more prudent couples to wait a little longer till times are better again.

Corn itself supplies us with another remarkable example of the extraordinary cross-relations and interactions which exist among all the factors in the balance of nature. For many generations farmers have had a singular and almost superstitious aversion to that pretty and seemingly harmless shrub, the barberry. Wherever its bright red clusters of pendent fruit were seen hanging temptingly from the hedgerows the bucolic intelligence was wont to assert that wheat would never thrive or prosper. Occupiers of handsome grounds laughed at this quaint and apparently meaningless notion ; and since the barberry, with its crimson fruit and pale green foliage, is a very ornamental little bush, they planted it freely, in spite of the farmers, among all their shrubberies. Of late years, however, microscopical investigators have

begun to find out that the farmers were right after all, and that the barberry-bush does really destroy the corn in its neighborhood. For smut or rust, that very destructive enemy of the wheat-plant, is really a small fungus or vegetable parasite, which passes through various stages, something like those of the caterpillar, the chrysalis, and the butterfly in the insect world. Now, the first or infantile stage of smut is passed in the barberry-leaves, from which the spores or tiny seeds of the fungus finally migrate, being blown by the wind among the nearest wheat-fields. But, if there were no barberry-bushes, there would be no leaves on which to nurse the young smut-fungi, and so the disease would soon be exterminated altogether. If we were to root up all the barberries in America, we should stamp out the smut with it. Farmers are beginning to be alive to this fact at present, and the poor barberries are being grubbed up with exemplary diligence out of all the woodlands.

Inter-relations of this sort are very common among cultivated crops, though it is only in quite recent years that the attention of naturalists has been fairly directed to them. There seems no good reason at first sight, for instance, why plum-trees should not be grown in the orchard of a hop-farmer; but Kentish experience has long shown the English farmer that hops are specially affected

by that destructive little insect, "the fly," a kind of green blight or aphis, whenever they adjoin a garden with plum-trees; and late researches have conclusively shown that the insect in question passes its early larval stage on the leaves of plums, and only later on in life takes to preying on the ripening hop-vines. Thus, strange as it may seem, the price of beer in England is in the last resort unfavorably affected by the number of plum-trees in Kent and Surrey. The year after a wet summer, in fact, is particularly bad for the hop-gardens; fly then usually abounds in prodigious numbers. And the reason is that a wet summer prevents lady-birds from laying their eggs in peace and quiet; and it is the grub of the lady-bird that chiefly keeps down "the fly," on which it feeds as its natural prey. Once more, that gaudy, yellow weed, the charlock or wild mustard, that often makes golden the wheat-fields on slovenly American farms, appears to be injurious enough in its own way to the wheat; but why on earth should it be accounted dangerous to the clean-kept turnip-fields? Simply because charlock is the native food-plant of the dreaded turnip-fly, which spreads from the little patches on the border of the fields to the long rows of neighboring turnips. Just so the terrible "potato-bug," or Colorado beetle, the pest and horror of American farmers, fed originally on a wild weed

of the Rocky Mountains allied to the potato, though much more shrubby ; but, as soon as cultivation in its westward development brought the true tuber-bearing plant, with its succulent stem and leaf, within reach of the Colorado beetle, that enterprising insect, struck immediately by its close resemblance to his ancestral food, observed to himself, in a thoughtful fashion, "I shouldn't be surprised if I could live upon that new-fangled plant there quite as well as upon the original solanum." He tried the experiment, and, to the horror of all America, it succeeded admirably. Thenceforward the Colorado beetle became a power in the world ; legislatures enacted statutes to his prejudice, and foreign governments watched their ports to prevent his entrance as jealously as if he had been a friend of humanity with a hundredweight of dynamite in a small black portmanteau.

All nature is one vast network of such continuous and ceaseless interactions. Kill off the sparrows or other small birds, and the grubs, worms, and insects increase enormously. In return, the plants and fruits suffer ; there are no gooseberries, no currants, no lettuces, and very few green peas. Drain the fens, and you upset the balance of life for a whole district. With the water go the fishes and water-weeds, the pond-snails and pond-beetles. Where there are no fish there can be no

herons and no moor-hens, few ducks, wild-fowl, or snipe. The birds that hunted for worms and insects in the soft ooze are driven elsewhere; the frogs, the newts, the toads, the dragon-flies are deprived of the hatching-places for their tadpoles or larvæ. The gnats and May-flies and small water-haunting insects disappear, and with them the swifts and swallows that chased them open-mouthed across the basking waters. One species of butterfly, peculiar to the English fens, became entirely extinct with the draining of Whittlesea Mere; many others which still survive in continental Europe were driven from their last English dwelling-place. In such a complex world as this it is impossible to alter a single factor without disturbing the whole balance of nature in a thousand particulars. So insignificant a fact as the accidental introduction of the Canadian river-weed into England has cost English canal-companies thousands of pounds in dredging operations, has converted ponds and reservoirs into festering masses of green stagnation, has killed out the trout and the crayfish in innumerable streamlets, and has fostered the growth of carp at the expense of bream, roach, and pike in hundreds of rivers. It is impossible even to kill a fly or a chipmunk without bringing about a whole petty revolution in the world around us. Not a plant but owes its safety to the friendly intervention

of one particular insect, and suffers destruction from the untimely attentions and depredations of another. If you catch all the caterpillars of a special sort which prey upon the tender shoots of your gooseberries, you are indeed insuring the safety of the leaves and fruit of those useful bushes; but you are at the same time exterminating the future moths by whose kindly aid your cabbages and cauliflowers can alone be induced to set their seeds for coming seasons. It is impossible for us ever to produce only the exact single result that we ourselves personally desire; whatever positive steps we take entail innumerable and far-reaching consequences which far outrun our feeble little human powers of calculation. Nothing in the world stands absolutely alone and isolated in its own domain; every fact and every object are but parts in one great continuous whole, infinitely varied, but infinitely interwoven and infinitely interdependent. Each creature has endless relations, not with one other creature alone among the many around it, but with the whole chain and group of creatures by which it is environed upon every side. It is the common error of the human species to underestimate the vast and wonderful complexity of nature, to suppose that it can deal with facts as isolated, and overlook the whole enormous series of remote consequences that follow of necessity upon every

act. Such an attempt is always futile, and brings with it its own condemnation. Whatever we do entails far more than we ever imagined, and carries with it an entire sequence of distant effects whose very existence we never counted upon.

XIII.

THE HORSE AND HIS PEDIGREE.

ONE of the most interesting and novel results of the impetus lately given to biological science is the power which it has now fairly attained of reconstructing for us to a certain degree the genealogy and past history of many among the most familiar cultivated plants and domestic animals. In no case has such a reconstruction been more fully or more satisfactorily effected than in the instance of our old friends and constant allies, the horse and the donkey. By a happy series of fortunate accidents, the fossil bones of all the intermediate links in the long chain of equine animals have been preserved for us among the upheaved rocks of various countries, but more especially of Western America. By comparison of their different minor details with one another, we are now enabled to picture to ourselves the successive stages in the evolution of horsehood, and to follow the fortunes of that very interesting and useful family, from the tiny ancestor, no bigger than a fox, who roamed at his own sweet will over the grassy plains of the early Tertiary period, down to

the noble creature whose arched neck and slender legs command the admiration of ten thousand connoisseurs on the English downs upon a modern Derby-day.

If we compare the horse, the donkey, the zebra, and their allies, as we know them nowadays, with all other forms of existing quadruped, there is one difference so immediately striking that it cannot fail to attract the attention of even the most casual and superficial observer. While other animals have five, four, three, or at least two toes, the horse family stand alone in the possession of a single solid and undivided hoof upon each of the fore and hind legs alike. It is this hoof, of course, with its firm tread upon the plain beneath, that gives the horse his undoubted superiority over all other forms of quadruped as a swift runner and a sure-footed, trustworthy beast of burden. The hoof, therefore, may be fairly looked upon as the great trade-mark or family scutcheon of the horses and their allies, the one chief point of vantage whereby they have made good their position upon all the great level grasslands of the world, from the South American pampas to the Australian plains, and from the African veldt, with its multitudinous herds of graceful zebras, to the Central Asian steppes roamed over in abundance by countless troops of beautiful onagers and Tibetan wild asses. Now, anatomy teaches us that

the solid hoof which thus distinguishes the horse kind as a group from all other types of less noble quadrupeds is in reality a single toe; the four other toes which the ancestors of the horse originally inherited from the common progenitor of the whole great mammalian group have been gradually lost through disuse in the course of long and slow ages, and only a solitary large and heavy nail at present remains in the horse and the donkey, in strict adaptation to the native habits of the great race as rapid scourers over the free plains of a wide, untilled, and grass-clad continent.

The earliest recognizable ancestor of the modern horse whose bones geological research has succeeded in disintombing for our inspection from the eocene rocks of Western America was a small creature no bigger than a fox, whose fore-feet had four large toes and a fifth much smaller one, while on the hind-feet the number of toes was, even at that comparatively early period, reduced to three. These pretty little primitive ponies must have stood, in point of size, to our modern Arabs in somewhat the same comparative relation as a toy-terrier now stands to a Cuban bloodhound or an English mastiff. They were, in short, mere baby-horses, Tom Thumb predecessors of our own gigantic Suffolk punches. But the world was all before them, on which to feed and grow, and the race still retained the plasticity of youth, which

enabled it to strike out new varieties in abundance, even better adapted than itself to the conditions of existence upon the broad table-lands of the great continents. The fewer the toes, the firmer the tread; and so, in a slightly later deposit, we find that the still developing horse-like creature has lost the useless fifth toe on its front foot, and has confined itself to four and three apiece on its fore and hind limbs respectively. As we trace the gradual evolution of the horse-kind upward through the successive stages of the Tertiary rocks, we find the animals increasing in size and diminishing in number of toes at each succeeding level of deposit. In the miocene beds of Oregon and Nebraska we come first upon a pony-like creature as big as a sheep, with only three toes upon the front feet, all of them hoofed, but with the central toe decidedly the biggest and the most firmly planted upon the ground beneath. It is this big central toe that has finally developed into the single hoof of our horses and donkeys, growing ever larger, broader, and more solid, while the side-toes grew progressively smaller, shorter, and more useless. By the pliocene period, once more, which succeeded the miocene, our developing horses have progressed from the size of a sheep to that of a donkey; and each foot has then got a large middle toe, on which the animal walks firmly, flanked by two smaller and unneces-

sary toes, which do not reach the ground at all, exactly as is the case with the small side-trotters or dew-claws of the pig and the deer in our own day. Next we find these useless side-toes slowly coalescing with the chief bone of the one central toe or hoof, till at last they remain in our own modern horses and donkeys only as those lateral knobs known to veterinaries as the splint-bones. To the very last, however, the horse retains in his existing skeleton the faint marks of the time when his ancestors possessed at least three distinct toes; and his present solid solitary hoof has been gradually developed in the long course of scouring over the open plains which form in the free wild state the natural dwelling-place of all his kind. Indeed, even at the present day the fully developed horse still shows at times a tendency to "throw back" to the primitive form of his remoter ancestry, and cases are on record of horses having been born with three distinct toes on each foot, after precisely the same simple fashion as their early geological progenitors.

Even more interesting, perhaps, than these remoter chapters in the ancestry of the horse are the traces which he still occasionally manifests in his outward appearance of his direct descent in later times from a striped and banded asinine animal like the modern zebra. There can be little doubt that, at the point when the horse family, in

its upward progress, had reached a stage equivalent to that of the zebra type, it must have been adorned by conspicuous black and white belts and markings along the whole length of its sides, its back, its thighs, and its legs. Among the different horse-like animals now known to us, there are several intermediate gradations in this respect, from the true zebra of Southern Africa, which is elegantly banded with black and white stripes over all its body, including even the tail and fetlock, to the true Arab, which is absolutely uniform in color from its nose to its hoof, and betrays not the slightest trace or remnant of the original banded variegation. Starting with the pure black and white mountain zebra, the most decorated and belted of all, we next get to Burchell's zebra, which is black and yellow, and has comparatively few stripes upon its head and body, with hardly any on its flanks, legs, and tail. Next in order to this transitional form comes the curious quagga of the now historical Transvaal, whose stripes are confined to his head and neck and the forepart of his body, without descending at all upon the legs or buttocks. The wild ass of Tibet still preserves the noble outline of the zebra group, but is not striped at all, having its back marked instead with a broad black band, without any trace of the transverse bar across the shoulders. The wild ass of Abyssinia, on the other hand, from which breed

our domestic donkeys are most certainly descended, has the well known cross fairly marked upon his back and shoulders, together with small banded zebra-like stripes upon his hind-legs. We may therefore pretty confidently conclude that the common ancestor of horses and donkeys was a zebra-like animal, more or less strikingly marked with black and white belts over the whole surface of his legs and body.

Now, our modern donkey, as Mr. Darwin long ago pointed out, often shows by reversion very distinct transverse bars on its legs, like those on the legs of the zebra; and these bars are most noticeable in the young foal, which thus follows the rule of all other young animals in conforming more closely than the full grown form to the peculiarities of its remoter ancestors. The stripe on the donkey's shoulder, again, is sometimes double, — a zebra-like trait which closely assimilates it to the wild quagga of the Transvaal pastures. Even among horses themselves, the dark stripe down the back frequently occurs in the most distinct breeds; and transverse bars on the legs have often been observed on duns and mouse-duns, and more rarely on chestnuts. A faint shoulder-stripe may occasionally be seen in the same cases; and Mr. Darwin once noted traces of the sort in a bay horse. A Belgian cart-horse had a double stripe on each shoulder, as well as leg-bars; and

a small dun Welsh pony had actually as many as three stripes, thus closely approaching the type of coloration that prevails universally in Burchell's zebra. It is impossible not to regard these curious facts as indications that our modern horses are ultimately derived from a more or less regularly striped and banded zebra-like ancestor. In the case of mules, indeed, we get an excellent opportunity of testing the reality of this hypothetical conclusion; for the mule is the offspring of the ass and the mare, and as such might naturally be expected to reproduce in its own person the primitive features of their common ancestor. Now, as a matter of fact, mules have almost always barred legs, and some of them have the bars quite as distinctly marked as on the hind-legs of a mountain zebra; they are also sometimes banded on the back and shoulders. In the young mule particularly, the stripes and bars are very common, and in the warmer parts of America — where the climate closely resembles that of their original sub-tropical home — these reversionary markings are almost universal.

The divergence of the true horse from the ass group is a still later and, we might almost say, historical event. Donkeys and their congeners differ mainly, as is well known, from the true horses in the fact that their tail is comparatively hairless in the upper part, with a tuft or brush of

long hairs at the end alone ; whereas in the horse's the long hairs begin from the very summit of the tail, and give it that peculiarly shaggy and noble appearance so very distinctive of the high-bred creature. Moreover, the donkey and zebra group have horny patches on the fore-legs only, while the true horses have them on both fore and hind legs. Till very lately no intermediate form between these two groups was known to exist, and the whole modern horse family was arbitrarily divided into a couple of distinct and separate bodies,—the true horses on the one hand, and the asses, zebras, and quaggas on the other. Quite recently, however, the indefatigable Russian traveller Prjevalsky has discovered among the high table-lands of Central Asia, on the Siberian side, a new intermediate connecting link, half way in size and appearance between the horses and the donkeys, with a coarse head and neck, and weak in his points, yet with the long hairs of his tail neither springing from the very top, as in the horse, nor collected in a tuft at the bottom, as in the donkey, but scattered about in the upper portion, and thicker and tuftier in the brush below. This undoubtedly intermediate species—a half-way house between horsedom and donkeydom—which has been named, after its discoverer, “Prjevalsky's horse,” represents in all probability a late common ancestor of the horses and the donkeys, or perhaps

we ought more correctly to say, a donkey-like animal arrested on its way to become a horse, and preserved for us by some lucky chance through so many ages in that remote and inaccessible region.

What renders this conclusion the more probable is the interesting fact that we still possess some excellent though very ancient portraits of extremely early European horses, scratched for us with the points of flint knives on broken fragments of reindeer-horn or mammoth-tusks by the dark and slouching prehistoric savages who dwelt among the caverns of Southern France while the great woolly elephant still roamed over the frozen plains of glacial Europe, and the cave-bear and hyena still sought their prey beside the ancient valleys of the Seine and the Dordogne. In these very antique sketches we are shown the counterfeit presentment of the wild horses which the men of the period stalked and ate, but had never learnt to catch and domesticate in their own service. The outline thus rudely engraved on a bit of bone or a fragment of antler shows us an animal with a large head, thick neck, and big mane, coarse and clumsy in all its points, but exactly like Prjevalsky's horse, and, what is still more important to notice, with the hairs of its tail springing, as in the newly discovered species, from half way down the stump only. There can be very little doubt, therefore, that at the date of the Glacial Period or

Great Ice Age the horse had reached only the stage of development shown us now by the new Central Asian species, and that it has since been improved (mainly, no doubt, by human care and selection) to the graceful beauty of the modern Arab, while its brethren of the Siberian plains, left entirely to their devices, have retained to this day the coarse points and clumsy outline which distinguished their early preglacial ancestors. It is interesting thus to be enabled to trace by gradual stages the development of a single great line of animals from the diminutive little five-toed eocene species, through so many and diverse intermediate forms, to the tall, stately, and noble race-horse of our own modern civilized epoch.

XIV.

THE BEST POLICY.

Is honesty the best policy? This is an inquiry which an old proverb has long ago answered for us off-hand in the affirmative; and the attempt to re-open the question now after it has been so long settled to everybody's satisfaction may seem to many people at first sight to smack of meddling with edge-tools—to be little less than wicked and immoral, or, at any rate, highly inexpedient. But, when we look a little more deeply into the matter, it is by no means certain that a comfortable acquiescence in the conception of honesty as the best policy is, in any measure, a necessary part of the highest and truest morality. Even if we are perfectly convinced in any particular case that a dishonest action would be for our immediate or permanent advantage, for example, that belief ought not in the least to weigh with us in the practical governance of our future conduct as moral beings. And, on the other hand, if we merely believe loosely in honesty because we think, in the common phrase, that “it pays in the long run,” we are not, in the truest and highest sense, honest at

all ; we are being guided simply in this matter by expediency and self-interest, not by high principle and due regard for the ultimate prevalence of abstract justice. The imaginary Quaker in the old story who knew that honesty was a better policy than dishonesty because he had "tried both" could not properly be considered as honest at all ; he was merely a clever and intelligent, but unscrupulous trader, who had found out by dint of experiment the best way of attracting and keeping a large connection of customers in this commercial universe of ours. A man who was honest on this ground alone would, of course, yield to temptation immediately, if in any particular case it became quite clear to him that by some single act of great dishonesty—say by forging a signature or by destroying a will—he could make himself comfortable in worldly circumstances for ever afterwards.

No ; the only kind of honesty really worthy of the name is that which proceeds not from a deliberate calculation of personal consequences, but from a genuine and deep-seated hatred and loathing for any dirty, mean, or questionable conduct. The truly honest man is the one who will not do a wrong act because the act itself excites in his mind, apart from consequences, an immediate disgust and almost instinctive repugnance. In this matter a great many estimable people really de-

ceive themselves to their own discredit, and underrate the true strength of the moral feelings in their inner personality. If asked why they do not do certain dishonest or disgraceful actions, they will probably answer glibly enough because they would be imprisoned or otherwise punished for them. But, as a matter of fact, the real deterrent in most cases, with all worthy persons, is not the fear of external punishment; it is the natural, almost instinctive hatred of the wrong action. There are instances in which this is so immediately apparent that nobody can for a moment fail to perceive the truth as soon as the issue is fairly presented to him. Why, for instance, do we habitually abstain from grossly ill-treating or cruelly abusing dumb creatures? Is it because the officers of the Society for the Prevention of Cruelty to Animals are always on the alert to detect us if we do, and to inflict upon us as penalty a paltry fine, not exceeding forty shillings? Surely not! It is because we cannot endure in our own minds the bare idea of brutal behavior towards a helpless and inoffensive animal. It is because an innate shrinking would hold us back from kicking or beating it, even if we were, for experiment's sake, to make a sort of vain attempt at so doing. This internal repugnance to any wrong act is, in fact, the true test whether in any particular respect we are perfectly or imperfectly

moral. There are modes of wrong-doing which have temptations for us all, each of us after his own kind—sins that do most easily beset us; and, as regards these, we are so far confessedly in an imperfect moral condition. But there are other modes of wrong-doing which present no temptation at all to many of us, brutal, or dirty, or disgraceful actions from which we shrink immediately of our own accord, and which no amount of inducement or encouragement could ever for a moment tempt us to commit; and, as regards these, we may consider ourselves so far in a perfectly and truly moral condition. The really honest man is thus the man who abstains from dishonesty not because he believes it to be bad policy, but because the bare idea of such conduct is immediately repugnant to his conscience and his better feelings.

Even if we take into consideration the existence of future rewards and punishments, the same thing is to a great extent true. To be sure, we may say that, from this point of view, at least, honesty is always in the long run the best policy, for all who believe in a retribution for deeds performed in this world. Yet here again a great many people, no doubt, deceive themselves at first sight, answering readily enough that they abstain from such and such acts from the just fear of future consequences. But, in reality, to abstain

on this ground alone is to take the very lowest possible view of our moral and religious obligations. Though the belief in the future retribution is indeed present, it is not the chief or the only motive; in the holiest characters it is the very least of motives. To do right merely for the sake of avoiding punishment or of obtaining reward, though, of course, a great deal better than doing wrong, is by no means the highest and truest morality. Far grander and nobler is the aim so beautifully set forth by the greatest of living English poets:—

“To live by law,
Acting the law we live by without fear,
And because right is right to follow right,
Were wisdom in the scorn of consequence.”

From the standpoint of the higher ethics, therefore, it is really a quite allowable question to ask whether honesty is or is not actually the best policy. Even if it should turn out as the result of our inquiry that it is not so, right-doing would thereby receive no detriment; for, whether a thing is profitable or not has nothing at all to do, in reality, with the ultimate question whether we can lawfully pursue it or otherwise. Happily, however, for the frailties of human nature, the old proverb does really seem to enclose the genuine kernel of a profound truth. There can be very little doubt that, on the average, and in the

vast majority of instances, honesty produces its material reward, even here and now, while dishonesty meets in the long run with its appropriate penalty. Of course this is true only on the average of cases. Nobody can doubt that there are many men who have amassed large fortunes by very shady or questionable means and who have been in every way what we commonly call successful people. To be sure, in a certain number of such instances, the owner of the ill-gotten wealth may have been subject, sooner or later, to the pangs of a remorseful conscience—but not always. It is quite clear that there are in the world, however painful it may be to us to recognize it, certain persons who are utterly incapable of feeling any remorse whatsoever for the most disgraceful or criminal actions, and who go to the grave without having ever experienced a single qualm or a passing pang for their most abominable and atrocious deeds. We may shut our eyes to the fact as much as we like; but it is a fact, and no amount of ignoring it will suffice to render it the less real. Cases, we must admit, do occur where dishonesty seems to be, so far as the present world alone is concerned, distinctly, from that very low platform, the best policy.

But such cases are, fortunately, extremely rare. In the world, as generally constituted, the need for trust and well grounded confidence between

man and man is so great that the honest dealer, in ninety-nine cases out of a hundred, has the best of it. It is so absolutely necessary for us to be able to receive one another's words freely, to believe in the due performance of contracts, to accept the ordinary warranty of goods—in short, to confide in the average honesty of the whole community—that the man whom we once discover in an untruth or catch in a flagrant piece of dishonest practice is pretty sure to lose forthwith the countenance or custom of all those who know of his delinquency. A good name is better than riches; and to lose one's good name is, in almost every ordinary instance, to lose the means of acquiring a livelihood. Of course, there are some few men whom we all know to be rogues, and who nevertheless manage to amass considerable fortunes; but such cases are quite exceptional, and are possible only in a very few out-of-the-way walks of life. In most professions, in most trades, and in most callings, services, or handicrafts, to be honest is, as it were, the prime requisite. A man may have ever so many other valuable qualities for his particular calling—knowledge, ability, intellect, quickness, industry, technical skill; but, if he is not honest, there is no room and no chance for him in the fierce competition of modern existence. However able he may be, he goes at last to the wall and leaves the field

free and open to his often less intelligent but more straightforward and trustworthy competitors.

Nothing could better illustrate the way in which this prime necessity for honest dealing between the members of an industrial community produces a general high level of individual honesty than to notice the mode in which a similar feeling is engendered by circumstances even among the members of almost savage and predatory tribes. In the Hudson's Bay Company's territory there are many places where the fur-trade of the company is not sufficiently large to support a resident store-keeper, and where there are absolutely no inhabitants except the thinly scattered hunting Indians. In such spots the company often erects a store, generally a large shanty, without any custodian; and the door of this rude building is secured only against the intrusion of bears or panthers, being carefully fastened from outside with a wooden bar or common drop-latch. Thus any person who happens to pass can enter it at any time and help himself to whatever he requires. It is, in fact, a shop without a shopkeeper. Within are stored all the supplies that an Indian is likely at any time to need—blankets, clothing, arms, powder, shot, and every other object of necessity to the surrounding hunters. A tariff of proportionate values is hung up behind the door in simple

picture-writing—so many skins in return for a gun, so many for a blanket, so many for a flask of powder, and so forth; and the relative worth of the different kinds of furs is also regulated by a fixed convention, well known by repute to all the neighboring Indians. When an Indian in the district requires any article from this singular store, he enters and takes for himself whatever he wants, leaving behind the requisite number of skins in barter, together with some little personal mark, which forms, as it were, his crest or cognizance, so that the company may be able to recognize the name and standing of their customer. This arrangement has existed for many years, and in no case, says Mr. Sandford Fleming, has an instance been noted of the stores being fraudulently entered, or of the least dishonesty taking place on the part of the Indians. When the agent comes to visit the stores twice a year, he invariably finds everything in order, and the proper number of skins for each purchase duly stacked in the middle of the shanty.

How is it that such mere savages have attained so high and apparently so difficult a standard of personal honesty? Clearly because they all feel strongly the obvious truth that in their peculiar circumstances, at least, honesty is decidedly the best policy. If in any one case an Indian were to break into and rob the store, he would know per-

fectly well that on the very next visit of the agent that particular store would be promptly closed, and he would in future suffer all the disadvantages of being cut off entirely from European traffic and European manufactures, which have become to him almost as necessary now as they are to ourselves. Instead of warm and comfortable woollen blankets, he would have in future to content himself with the skins of beasts. Instead of a good gun, powder, and shot, he would have in future to subsist upon the precarious returns of the chase with the bow and arrow. Instead of wheaten flour, maize, and tobacco, he would have in future to go back again to the miserable roots, berries, and leaves which formed a large part of the simple food-stuffs of his roaming ancestors. Every Indian in each little community, therefore, feels that on his own personal honesty, as well as on that of all his fellows, depends the continuance of the useful system whereby he and his people are enabled at any time to satisfy their wants in the utter wilderness with almost all the ease and certainty of a civilized city, with its numerous shops and busy market-places. Not only, accordingly, does he willingly abstain himself from acting dishonestly, but he also endeavors, as far as in him lies, to enforce honest dealing on all his neighbors and fellow-tribesmen. The sort of influence thus brought to bear so very obviously upon

each person in such a savage tribe is also brought to bear upon all civilized people in our own communities, though often by far more indirect and roundabout methods. The knowledge that honesty is the best policy for everybody all round, and that dishonesty is hurtful for all of us alike, helps to keep the less scrupulous from falling into evil ways, and makes the more scrupulous all the more careful in not encouraging or countenancing in any way any but those of known and tried personal probity.

XV.

THE ENGLISH PEOPLE.

EVERY nation at the present day is a compound of numberless distinct elements; but few nations are more absolutely compound, more closely intermixed of varying races, than the English people and its offshoot, the American race. Even if we take merely the well known historical components of the population in England proper, omitting Ireland, Scotland, Wales, and Cornwall, we have an extraordinary conglomerate of the most diverse Celtic and Teutonic elements. As Defoe long ago satirically observed, when he wished to cast ridicule upon the supposed purity of blood in certain sections of the community, —

“ With easy pains you can distinguish
Your Saxon, Norman, Danish English.”

The real fact is, of course, that almost every individual in our existing society can trace his descent in one line or the other to Saxon, Norman, Dane, and Celt alike, and to many still older and all but forgotten components of our very mixed British nationality. Each of us has necessarily two

parents, four grandparents, eight great-grandparents, sixteen great-great-grandparents, and so on *ad infinitum*; and the chances of any one single personage being able to make out a pure Norman, or Saxon, or Danish pedigree, down to the tenth, eleventh, or twelfth generation, may be practically regarded as what mathematicians term a vanishing quantity. Whenever a genealogy is carefully worked out in the ascending order through all lines alike, it is almost invariably found that a few generations back it ramifies out widely into all parts of the country, and embraces elements of the most diverse possible ethnological origin and social *status*.

But of late years it has also become increasingly clear that, in attempting to account for the various race-elements which go to make up the existing composition of any particular nation, we have to take into consideration not only the well known historical factors, but also the less obtrusive but far more deeply persistent prehistoric peoples who everywhere occupied the soil of each country before the advent of the first historical colonists. Egypt, for example, is a country which from all time has been constantly overrun and conquered by Persians, Greeks, Romans, and Arabs, who have formed from time to time its upper classes and governing body; yet to this day the preponderating portion of the Egyptian

population, whether Mohammedan fellahs or Coptic Christians, consists essentially of the original ancient Egyptian type, persisting still as the main element, in spite of foreign conquest and gradual intermixture of the immigrants with the natives. It may be interesting, therefore, from this point of view, to consider briefly the various races, historical or prehistoric, which are known to have successively occupied the soil of Britain, and to inquire what light modern research has thrown upon the parts which they have each respectively borne in the building-up of the existing composite British people.

The very earliest inhabitants of what is now England, known as yet to the ken of science, are the extremely antique and savage folk who fashioned the rudely chipped flint hatchets found in the drift or river-gravel and the somewhat shapelier rough stone arrow-heads exhumed from the solid concrete floors of the limestone caverns. But these most venerable of all ancient Britons have left, it would seem, but little mark upon the existing modern British people. To be sure, in one sense it is not improbable that we of nineteenth-century England may be largely or even exclusively descended from the crouching, dark-skinned, Australian-like savages who hunted the mammoth beside the banks of some primeval and forgotten Thames, or who fed upon the flesh of

the seal and the reindeer among the ice-encumbered caves of preglacial Yorkshire. But, if so, the enormous lapse of time which has intervened to separate us from these our earliest recognizable British ancestors has produced so immense a modification in type and feature as to render us practically a different race from our remote progenitors. For the men of the older stone age, as archæologists call the very early barbarous inhabitants of still Continental Britain, were a horde of exceedingly low and primitive savages, with smaller brains than any existing group of the human family, and with traits which mark them out as inferior even to the naked Australian black fellows of our own time. All the evidence we yet possess goes to show that these primitive people were driven southward into Mediterranean Europe by the gradual approach of very cold conditions in the area of Britain; and therefore we have comparatively little reason to suppose that their blood has left any distinct traces on the modern population of the British Isles.

It is different, however, with the second great group of people who are known to have settled on the soil of England. The men of the newer stone age, who colonized our island immediately after the return of warmer and more genial conditions in Northern Europe, have evidently contributed no small proportion of their blood to the

mixed Englishmen of the present day. Cultivators and herdsmen where their predecessors of the older stone age had been mere hand-to-mouth hunting savages, these oldest of existing Englishmen were characterized physically by their comparatively dark complexion, black hair, deep brown eyes, and long or boat-shaped skulls and foreheads. It was they who raised the most ancient among the barrows or tumuli which still cap the summits of our chalk downs: and from the chambered stone tombs that the barrows enclose we have recovered not only the polished stone tomahawks, the amber necklets, the hand-made pottery, and the simple ornaments of these primeval Britons, but also the actual bones and skeletons of the builders themselves. From the physical indications thus unmistakably preserved for us we know the constructors of the chambered barrows to have been a short, squat, and thick-set people, identical in type with the so-called black Celts of Scotland and Ireland, and with the darker inhabitants of Lincolnshire, Yorkshire, and the Eastern Counties. Throughout the whole of Britain indeed careful investigation and measurement of skulls, bones, and height, as well as observations on the color of hair and eyes, have united to prove that many great groups of people exist here and there in isolated colonies belonging mainly to this very early stone-age blood. Of

course it is not meant that these people have intentionally or entirely kept up their purity of race from any later foreign intermixture across so many intervening centuries; on the contrary, it is almost certain that even into the remotest valleys or peninsulas every successive wave of population must sooner or later have penetrated in some force, and have gradually amalgamated with the sedentary population. But it is more than probable, on the other hand, that wherever in special districts, and more particularly in the country, a short, dark type of humanity preponderates, there the people of the newer stone age have left their mark deeply upon the blood and figure of the modern inhabitants. Newer races settled in time among them, conquered them, and enslaved them, turned them into serfs, and slowly mixed with them by intermarriage; but the primitive dark type asserts itself still by constant inheritance, so that even in England proper, where we ought all to be fair-haired and blue-eyed Anglo-Saxons, according to the common notion of the English Conquest, black curly locks and dark eyes are almost or quite as common at the present day as the true Teutonic flaxen hair and cerulean iris.

The next great race to settle in England was that of the genuine Aryan Celts. A fair Northern race, coming down upon all Western Europe from the direction of Russia, the Celts seem to have

overrun England at a very early date, and to have conquered and enslaved its primitive dark non-Aryan inhabitants. The mixture slowly produced by the amalgamation of the two formed the Ancient Britons of the days of Cæsar and of the Roman conquerors. At that period, if we may trust the fragmentary Roman notices, the western half of Britain was peopled — as it still is — by a darker and more Spanish-looking type of men, like the modern Cornish and the Welsh of Glamorgan; while in the southeast a somewhat fairer type prevailed, which seemed to the swarthy Italians comparatively flaxen-haired and blue-eyed, though doubtless it possessed these characteristics in a less degree than the later Anglo-Saxon invaders.

The Romans, in spite of their political greatness, can have left but little mark upon the blood of England. Though the Roman occupation lasted nearly four centuries, though Roman roads traversed the country from end to end, though Roman villas studded in hundreds the fertile uplands, and though Roman legions were stationed at all the great strategic posts throughout the whole of England, yet the Romans really held Britain much as we ourselves hold India, by a purely military and imperial domination. If the English were to withdraw from Hindostan to-morrow, the blood of that great heterogeneous country would

hardly be affected to any appreciable degree by the hundred years of the English occupation. It was much the same, no doubt, with Britain. The so-called Roman soldiers stationed in the country were really recruited in Germany, Hungary, Spain, or Africa; and, though they may, of course, have mingled a little with the people of York or Chester, of Lincoln and of London — the great military and commercial posts — they cannot to any appreciable extent have influenced the physical features of the population of Britain generally.

But, when the Roman forces were withdrawn, the Teutons of the North, first as Anglo-Saxons and then as Danes, began to pour down upon the defenceless provinces. Like their predecessors, the Celts, the Teutons were also members of the great Aryan family of nations — that family which has spread itself from Norway to India and from Spain to Russia, and which now threatens to swallow up under its own dominion all the rest of the habitable globe. It was formerly usual to suppose that the Aryans had spread westward from Central Asia into the Russian plain and the remainder of Europe; but a Scandinavian scholar, Penka, has lately shown conclusive reasons for believing that they really started rather from the north and moved southward and eastward, movements of conquering hordes being always from the colder, rugged, and more mountainous

regions in the direction of warmer, more fertile, and wealthier plains. The Anglo-Saxons, or true English, who thus settled after the departure of the Romans in the country now called, after their name, England, did not, it is probable, exterminate or drive out entirely the earlier and darker half-Celtic population. Had they done so, the people of England at the present day would be, without exception, as light-haired and blue-eyed as in the fairest parts of Norway and Sweden. But, as a matter of fact, in modern England dark curly hair and black or blackish eyes are to be found in quite half of the existing population. Into Wales and Cornwall the conquering English never really penetrated in force at all, and the population in those two districts still consists almost entirely of the mixed dark race which we now commonly know as Celtic, in contradistinction to the lighter Teutonic Anglo-Saxon type. Cumberland, Westmoreland, and the greater part of Lancashire, though afterwards partially settled by the Northmen, similarly escaped the Anglo-Saxon colonization. In Devon, Somerset, and Dorset, as well as along the Welsh border in Hertfordshire, Worcestershire, Shropshire, and Cheshire, the invading English appear to have formed a mere sprinkling of a superior class among a large mass of subject or servile Welsh cultivators. And even in the most thoroughly

Teutonized counties of Britain, such as Kent, Sussex, Lincolnshire, and Yorkshire, it is not difficult to meet among the population with abundant traces of a yet unswamped dark element. Everywhere, in fact—even in the most English portions of England—a British race which is not English survives and flourishes to our own day in considerable numbers.

The later invasions hardly did much to disturb the general balance of our population thus roughly indicated. Danes and Normans were both essentially Teutonic at bottom; and both settled for the most part in districts which had already been colonized by English and Saxons. Indeed, the only great change in this respect which has come over the ethnography of England in later times has been brought about by a peaceful return-wave of the darker so-called Celtic race upon the lighter Teutonic districts in the southern and eastern half of our islands. Welshmen, long driven backward by the English arms, have now quietly crossed the border in their turn, and settled by the thousand in Liverpool, Birmingham, Manchester, and London. Highland Scots have descended in force upon Edinburgh and Glasgow; while not a few of them may be found scattered freely here and there even in the most southern English cities. Cornishmen, Devonians, and other West-Countrymen, have swamped into Southampton, Ports-

mouth, Chatham, Brighton, and the whole populous metropolitan area. As for the Irish, they are numerous everywhere, but especially in Bristol, London, Liverpool, Glasgow, Manchester, and Sheffield. The natural consequence of this slow and peaceful return-wave of the conquered Celt upon the conquering Saxon has been of course largely to increase the dark aboriginal element in our population and to swamp the light and purely Aryan element. Moreover, the Celt — or, in other words, the mixed dark race — increases and multiplies much faster than his fair brother, the Saxon; so that at the present day there can be little doubt that the dark type on the whole predominates over the fair, taking one part of the country with another throughout the whole of the British Islands. It may be added that close observation among distinguished men of the present day does not by any means bear out the common but probably groundless belief in the mental superiority of the lighter type.

XVI.

BIG AND LITTLE.

ALL our ideas, say the philosophers, are relative; it is impossible to state with absolute truth of anything in heaven or earth that it is really just thus and thus in itself, and not otherwise. Everything is what it is only relatively to something else, not absolutely and of its own inner essence. Take, for example, the question of direction. At first sight it might seem easy enough to decide whether we are going eastward or westward; but in fact the question is a very complicated one. A man is walking, to employ Mr. Herbert Spencer's admirable illustration, upon the deck of a steamer, outward bound, suppose we say, from Liverpool to Halifax. Relatively, therefore, to the other people and objects at rest on the vessel, when he walks from bow to stern, he is travelling eastward, and when he walks from aft forward he is travelling distinctly and unmistakably to the west. But the ship, too, with all that is on it, is moving in a right line westward; and so, even when he seems to be going east, he is really being far more rapidly carried, at the rate of nineteen knots an hour, in the opposite direction. That is

to say, he is so carried relatively once more to the two continents of Europe and America, getting every moment farther from the one and nearer and nearer still to the other. Yet in reality, at that very same second of time, the earth, in its daily revolution, is whirling him ever so much farther from west to east; so that, when the ship appears to be moving westward, it, with the ocean and the continents around it, is actually being hurried with amazing speed in the contrary direction, eastward and eastward. Once more, the entire earth itself is at the same instant spinning with still vaster haste in a wide circle through space around the sun; so that the real motion of the man on the ship is one compounded of his own movements, the movements of the vessel, the daily rotation of the earth on its axis, and the annual cycle of our planet around its primary the sun in a great orbit. Nor is this all. The movement so compounded, again, is relative only to the solar system; while the whole solar system itself *en bloc*, sun, and earth, and ship, and passenger together, is all careering wildly through illimitable space towards a particular star in the constellation Hercules. And whither we are all going in the lump, system, and star, and constellation, and galaxy, no astronomer has ever yet been able, with any approach to certainty, to determine.

In nothing is this infinite relativity of human ideas more clearly or impressively visible than in our common very vague conceptions of big and little. St. Paul's appears to us from most points of view a very large and imposing building, even if we frankly admit its architectural feebleness and its commonplace construction. On the other hand, the isle of Portland, in Dorsetshire, appears to us but a small place, a little peninsula of solid rock, on the central knoll of which a man can stand and look upon the sea and the cliffs on every side close around him. Nevertheless, St. Paul's was built of Portland stone, and so were half the other largest buildings in London; and for two hundred years the unwearied quarrymen have gone on pegging away without stopping at the narrow area of that tiny island, removing huge slabs — observe, we call them huge — for the construction of innumerable “gigantic” and “imposing” façades, without so much as visibly lowering the general surface of a few acres in the centre of Portland. St. Paul's is big, because we measure it against other and smaller human edifices; the blocks are huge, because we measure them against bricks or building-stones of human fashioning; but Portland is small, because we measure it not against any puny human object, but against Wight, or Arran, or England itself.

Take, once more, the utter impossibility of truly realizing to our own minds even very minor bignesses of size in external nature. Look at England itself! A single county, when we come to walk or ride or drive through it from end to end, is larger far than we can really picture to ourselves in our mental imaginings. The bicyclist who has gone through the length and breadth of Surrey or Sussex—to mention the counties most familiar as a rule to the London amateur—knows that even those fractions of England are too big to be adequately represented in a single inclusive act of memory or imagination. How, then, can any one of us pretend that we have really and truly a genuine conception of the relative bigness of all England? We know it in fact merely by rough ideas derived from railway-travelling; it took us so many hours to go by train from London to Penzance, and so many more to drive by coach from the Penzance Hotel to the Land's End. We were so long in going from Carlisle to Dover, and so long in getting from Carnarvon to Yarmouth. In this way we frame symbolically to ourselves some rough idea of the size of our native country, not, indeed, as visible at a single inclusive bird's-eye view, but as traversable by rail, or as measurable by means of the time required for transit across it. From this point of view, no doubt, railways have really made the ideal England

far smaller than it used once to be, by reducing the time needed to get over it from sea to sea. As we justly say, they have brought London several hours nearer to York or to Exeter. But, on the other hand, it can hardly be denied that they have given us all a far less true idea of the relative bigness of the whole country, compared to the part of it we know personally, by diminishing the number of intermediate points, and especially by getting rid of those hilltop views which in coaching times enabled one to measure with comparative accuracy the actual extent of the distance traversed.

Now let us turn for a moment from the area of England to the greater area of the rest of Europe. England and Wales themselves make up less than one-half the surface of the British Isles, which we may take, for convenience sake, as a unit of measurement; though nobody can pretend that he knows them all so well, from Cape Clear to the North Foreland, from John o' Groat's to the Lizard Point, as to be able to frame a definite picture of their actual bigness. Really, when we compare Britain with other countries, we do not even pretend to ourselves to compare the genuine areas; we think only of the relative space occupied by the representation of each of them on a tiny map. Any man who has once traversed England by rail, from Berwick to Dover, and

France by rail, from Marseilles to Calais, will feel immediately how hopeless is the attempt truly to compare their respective areas, otherwise than as represented by railway time-tables, or by painted figures on a piece of paper. Now, France alone is nearly half as big again as all Britain, and the German Empire, fairly divided out, would just split up into three Englands and three Waleses. Russia in Europe, with Poland and Finland, equals no less than thirty Englands, or over fifteen British Isles; and Europe as a whole is nearly twice as big as all Russia. Can anybody pretend that he can picture to himself, however inadequately, the real expanse of that vast area? Imagine no less than sixty countries as big as all England and Wales, of which smaller unit most of us have personally seen but a few counties! We say, imagine it; but, as a matter of fact, it is quite unimaginable; we can only symbolically represent to ourselves a far smaller and simpler stretch of country.

Again, we must bear in mind that Europe, as a whole, huge as it seems, is but a tiny fraction of the habitable land, the smallest and narrowest of the great continents. The Indian possessions of Britain, alone, are thirteen times as big as Britain, or twenty-six times as big as England; and the population is two hundred and fifty-eight millions, as against only thirty-six millions

in the British Isles. The United States are larger still — roughly speaking, about thirty times as big as Britain, or sixty times as big as England and Wales. Yet the United States are only a fraction of the land surface of all America, and America itself but a fraction of the land surface of the entire globe. As to the oceans, they are far bigger than even the continents. Scarcely more than one-quarter of the world consists of dry land; nearly three-quarters consist of water. Against some small portion of this we are able to measure ourselves with rough accuracy. The route from England to America, on a first-class passenger-steamer, requires on the average an eight days' voyage. During all those eight days and nights, whether we sit on deck or lie asleep in our berths, the vessel is moving steadily forward through the rushing water at the rate of seventeen or eighteen miles an hour. Every morning we start apparently in the middle of the ocean; every night we find ourselves, so far as the eye can judge, in exactly the same spot as where we started. But all the time we are steadily progressing across that vast and trackless waste of waters. Nothing else perhaps can ever give one such a vivid idea of the expanse of our globe as such a long ocean voyage. Yet from Queenstown to New York is but a tiny fraction of the distance round the whole world, scarcely more

than one-tenth part of the entire circumference of the earth at the equator. It is quite impossible for us really to picture to ourselves the world on which we live as a solid globe of its true size and comparative dimensions to other known bodies. When we try to do so, we deceive ourselves, and think only of a small ball, sufficiently little to be seen almost all round at once, and no more comparable to the actual planet than a grain of sand is comparable to a county of England.

If it is thus impossible for us to figure to ourselves our own world even, how infinitely more impossible is it for us to figure to ourselves the sun, the system, and the galaxy generally! St. Paul's is big, but London is bigger; an English county is beyond our mental grasp, but England itself is still more infinitely beyond it; yet England is only an atom in Europe, Europe in the continents, and the continents themselves in the world that contains them. Then the world itself, that vast unit, so huge that we cannot even pretend to picture its greatness mentally to ourselves, becomes far too tiny for a useful standard when we come to consider the infinities about us. As a planet even, the world sinks into utter insignificance beside its giant neighbors Jupiter and Saturn. It would take nearly thirteen hundred worlds as big as our own to make up an earth of the same size as Jupiter. We cannot conceive of

our own world as a whole, of course; but we may perhaps make the proportions conceivable if we think first of the earth as a pea, and then of Jupiter as equivalent to thirteen hundred such rolled together. Saturn, once more, though not by any means so big as Jupiter, is about seven hundred and fifty times as large as the earth. These of course are very big planets, and in themselves they might fairly be considered nothing less than positively gigantic. But, viewed by the standard of the sun, their ruler, they dwindle at once into mere babies. Jupiter is thirteen hundred times as big as the earth, but the sun is one million three hundred and eighty-four thousand times as big; in other words, it would take more than a million and a quarter bodies as big as our world to compose a body as big as the sun. Surely here, we may well suppose, we have reached the very topmost summit of bigness. Not a bit of it. Compared to the earth, the sun is indeed inconceivably vast; but, compared to the other fixed stars about him, he is in all probability the merest pigmy. We cannot accurately measure the stars as we can measure the planets, but there is reason to believe that the star called Alpha, in the constellation of the Centaur (the nearest one to our own system), is nearly two and a half times as big as the sun, and that Sirius, the brightest star known to us, is three hundred and

ninety-three times as big. As there are a thousand million distinct stars within the range of the best telescopes, and as among all these our own sun is but an insignificant third-rate unit, it may well be believed how inconceivably vast are the abysses of space with which the astronomer has to deal.

On the other hand, when we come to consider the infinitely little, we are met by almost equally inconceivable gradations of successive minuteness. An elephant usually passes for a big animal, though, considered side by side with the gigantic realities we have just been examining, he may be regarded of course as a tiny speck in a lost corner of the universe. On the other hand, a gnat is ordinarily looked upon as a very small and insignificant creature; and yet there are myriads of creatures tinier still, compared to which the gnat himself is as big, we do not say as the elephant, but as a whole broad English county. If one takes a little hay, and soaks it in water for a few hours, a drop of the infusion placed under a microscope will swarm with tiny creatures of jelly-like appearance, darting about with inconceivable rapidity, and every one of them quite as alive to all outer show as the elephant himself. Yet twenty thousand of them put in a circle would not more than fill up the letter *o* in the type with which this essay is printed. Between

these intensely minute microscopical creatures and ourselves or the elephant every intermediate stage exists, plants and animals shading off in size to practically illimitable extents, from the whale and the oak-tree down to the infinitesimal objects which can hardly be distinguished by the acutest eye with the very highest powers of the best microscopes.

Time affords us equal vistas of infinite duration and of infinitesimal subdivision. Our little human life, our days and years, give us indeed no proper standard for measuring the vast past extent of geological ages. A man's utmost span, even in cases like those of Sir Moses Montefiore and M. Chevreul the chemist, barely exceeds a hundred years. But the glacial epoch, the very newest of geological dates, lies behind us (according to Doctor Croll's calculations) at a distance of two hundred and forty thousand winters. Man is now known to have existed on the earth for at least that very lengthy period, and in all probability for much longer. But before the glacial epoch began came the far longer pliocene age; and before that the yet longer miocene; and before that again the still more extended eocene. All these were as mere single days in a long year compared with the vast unmeasured extent of the secondary age; and the secondary age itself was but a tiny fraction of the still more illimitable primary period. Thus in time, as in space, the

vistas we gain down the remoter abysses are utterly unrealizable in terms of any ordinary human standard. Yet, when we come to look at the matter the opposite way, we see that what seems to us an indivisible second, the swing of a pendulum, is really a lapse of time sufficient for many separate actions to take place many hundred or even thousand times over. A gnat's wings vibrate one thousand three hundred times in a second; the note C in the middle octave of an ordinary piano vibrates five hundred and twenty-eight times in a second; the note A in the highest octave vibrates three thousand four hundred and eighty times in the same interval. Consider that each one of all these vibrations must itself occupy in reality a definite and measurable space of time, and it will be clear at once how comparatively long a period is that required for the utterance even of the proverbial name of "Jack Robinson." But this is nothing. The light-waves needed to produce red lights oscillate four hundred and seventy-seven billion times a second; those which yield the color violet have six hundred and ninety-nine billion oscillations in the same time. After this, how can we deny that big and little are all mere matters of human comparison? Nothing is long or short, small or great, in its own essence; it is so only in relation to something else, from the infinitely vast to the infinitesimally tiny, from the illimitable galaxy to the microscopic atom.

XVII.

THE ORIGIN OF BOWING.

WHEN a little dog sees a big dog advancing towards him in a threatening attitude, he not infrequently throws himself submissively down upon the ground, rolls on his back with obtrusive humility, fawns and grovels before his possible enemy, and seems to say, with all the eloquent voice of canine pantomime, "You needn't attack me, great sir. I am beaten already. I am your very obedient humble servant. Let me alone, you mighty conqueror, and go and fight the other bad dogs who won't acknowledge your obvious superiority as readily as I do." At first sight there would seem to be but little connection between this familiar action of the small dog before his powerful neighbor and the human ceremony of bowing and courtesying. And yet, as Mr. Herbert Spencer has acutely remarked, the two things are in their remote origin practically identical; the one springs at first from exactly the same instinct as the other. To bow to a man is even now to some extent a mark of respect or an acknowledgment of his official or social superi-

ority; and once upon a time it was far more — it was a tribute of submission and an act of obeisance, a deliberate prostration of the slave or captive at the feet of a master, a sovereign, or a conqueror. Many of our ordinary little modern ceremonial observances in the common etiquette of every-day intercourse similarly descend to us from a remote savage ancestry, and still bear upon their very faces no slight reminiscences of their barbaric origin. Among them not the least is the practice of bowing, which at present denotes no more than the customary politeness of men to women, or in a less degree of youth to age and of the ordinary run of society to exceptional rank, benevolence, or intellect, but which once had a far more servile meaning, and consisted of a deeper bodily obeisance.

In the East, where polite ceremonial has always been carried to the furthest extreme, we see the best evidence of the origin of bowing in pure physical savage prostration. There the servant salaams humbly before his master, and the subject throws himself, not figuratively, but literally, at the foot of the throne, for his superior to behold his absolute submissiveness. When we go still lower down to pure savages, the original meaning of these bodily obeisances, and their close connection with the humble demeanor of the little dog before his aggressor, become still more clear,

evident, and indisputable. The noble red men of the West, especially among the lower and more degraded tribes, if suddenly overtaken alone by a body of white men, crouch upon the ground and hold down their heads, as if inviting the newcomers to strike and kill them. Like the small dog at the approach of the big mastiff, they seem to say, "We will not resist you. We are your inoffensive slaves. Do as you will with us. We expect to be killed and eaten immediately." The South Africans in similar circumstances throw themselves down on the ground upon their backs, grovel in the dust, and slap their thighs violently with their open palms, to show that they have no weapons or arms of any sort concealed anywhere about them. It is from this primitive savage substitute for a flag of truce that the whole idea of bowing and scraping has been gradually developed with the rise of humanity. Sometimes, indeed, the notion of abject submission is even more graphically and humbly expressed. In the South Sea Island and in parts of Africa, the common people throw themselves down on the road before their chiefs, and put their necks beneath the great men's feet. In the East, from time immemorial, the conqueror has always thus symbolically shown the degradation of the conquered. In the Assyrian sculptures, the king is represented setting his foot upon the neck of cap-

tive princes; and the phrase derived from this ancient practice has passed, like so many other phrases derived from obsolete ideas, into the common stock of our modern languages. That the foeman's heel is on our necks, or that the rich man puts his foot upon the neck of the poor, is even now a familiar trope of popular oratory.

From throwing yourself flat on your face upon the earth to bowing low or salaaming, after the fashion of Oriental peoples, is a very easy and natural transition. It is, as it were, an expression of readiness and willingness to grovel. In everyday life, as soon as men begin to wear clothes, it is inconvenient absolutely to fall on the face, especially out-of-doors; the dust and mud are highly detrimental to the personal appearance in such circumstances. So in time, and among more civilized people, the ceremonial abasement gave way slowly to a sort of shortened and abridged edition, an incipient obeisance or apology for a prostration, the bow or salaam in its full form, as indulged in by Hindoos, Egyptians, and Persians. Knocking one's head against the ground, as is still done in China, is a yet profounder mode of curtailed abasement; it does not go quite so far as the actual prostration of the body in the dust, but it is more suggestively humble, and savors more of complete and utter submission than even the low bow of East Indian servants. Another

form of the ceremonial symbolism of subjection is to fall upon the knees; and from one of these forms we get our modern bow, while from the other we get the female courtesy. Courtesying is, as it were, a kind of incomplete kneeling, a motion made as if in the direction of falling down on the knees before a lord and master, supposed to be peculiarly appropriate to the weaker vessel. It stands to the ceremonial kneeling of Japanese and Eastern servants much as touching the hat or raising one hand gingerly to the brim stands to the more deliberate and formal salutation we give to ladies, or as a friendly nod or a master's slight inclination of recognition stands to the deferential bow of a servant or inferior. Scraping among men, seen even now among a few rustics, who always draw back the right foot as they bow, is another faint relic of the kneeling ceremony. In fact, whenever we now bow to an acquaintance, we are using in an abridged and purely polite form an ancient prostration which once meant, "I am your slave and captive. I am beaten and conquered. Do as you please with me. I will not resist you. Kill me or command me." Like the equally meaningless phrases, "Yours to command," or "I am, sir, your obedient servant," it is a long survival from an earlier and more servile stage, and it points back at last to a very rude and savage origin.

But why do we raise our hats in bowing? The unsophisticated savage in his native haunts seldom wears a hat at all; and when he does, he is not in the habit of lifting it gracefully to the ladies of his tribe whenever he meets them. His recognition of the fairer sex is far more likely to assume the ungallant form of soundly kicking them, a practice not wholly extinct even in the placid bosom of our modern British civilization. Nevertheless, even the practice of lifting the hat is in itself an exactly similar survival from an early savage propitiatory custom. For, when one savage conquers another, whether he kills him or not, the first thing he does is to strip the body, alive or dead, of all its weapons, armor, and ornaments. Even in the Homeric poems, when a noble Greek slays a noble Trojan, he proceeds immediately with heroic utilitarianism to loot and strip the bleeding corpse; when he takes one alive, and makes a slave of him, he snatches the golden trinkets from his neck and appropriates his personal property generally as the spoils of war and the perquisite of the conqueror. To this day, when a Zulu or an Afghan catches poor Tommy Atkins straggling incautiously from the line of march, he takes over the red tunic and the belt and haversack as his own trophy of the inglorious victory. Now, just as the savage throws himself on his back or falls on his face to symbol-

ize his complete submission, so, also, when resistance is impossible, he voluntarily offers up his arms and clothing to the stronger party, in the hope thereby of purchasing his life. "Here," he says in effect by his actions, "take all I have — my spear, my shield, my necklet of beads, my girdle of grass, or skins, or wampum; take my feathers, my anklets, my amulets, and let me go, a naked and defenceless creature, your slave and your captive, wherever you may lead me. If you give me my life, I am amply satisfied."

This practical giving-up of arms and clothing, begun as a means of propitiating a conqueror, becomes at last a ceremonial usage, much in favor among savage or barbarous kings, who often thus exact their tribute from their vassals and feudatories. Sometimes the minor chiefs, on the annual reckoning day, present themselves, gorgeously attired, at the palace of their sovereign, and one by one strip off and hand to him their long rolls of red cloth and their barbaric gewgaws, often at the same time putting their necks humbly beneath his feet, as if to renew their homage and acknowledge their submission. In certain cases etiquette demands that they should leave the royal presence utterly unclothed; in other instances they are required to give up only the more ornamental part of their outer covering, and to retain as much as is strictly necessary for the bare purposes of

decent clothing. There are countries where slaves must always appear naked at least before the faces of chiefs and kings, and others where their inferiority is marked only by their less amount of clothing, and by the upper half of the body being left uncovered. From this beginning every intermediate stage occurs, somewhere or other in the world, up to the mere formal lifting of a hat or cap as a mark of politeness or a token of inferiority. In Abyssinia and in some of the South Sea Islands, whenever common clay meets a great chief strutting along with all his followers, common clay unclothes itself down to its dusky waist, as if to say, "We are your slaves. Take our clothes; they are yours; we yield them up to you with a good grace!" In all the countries where men wear hats, they remove their hats also as well as their upper garments; and to stand with one's hat on in the presence of a superior has always been considered even in civilized countries a specially unwarrantable piece of insolence. To be bareheaded is the mark of servitude; and so, when King Edward, in that very unchivalrous fit of vulgar spite, demanded expiation on the part of the burgesses of Calais for their long and gallant resistance, Eustache de St. Pierre and his brave companions were brought before him bare of head, stripped to their shirts, and with halters of rope fastened round

their necks — a truly barbarous expression of complete submission, surviving strangely into the so-called age of chivalry. In the East it is the shoes rather than the hat or turban that men usually remove as a sign of respect, perhaps because of the danger of sunstroke were they to stand uncovered under an almost tropical sky. In Burmah even at the present day, every Englishman who approaches the king's presence has to do obeisance by taking off his shoes, just as in England people kiss the hand of royalty; and in Persia no one may come near the Shah without baring his feet in token of submission. Shoes are left at the doors of the mosques, exactly as we ourselves uncover our heads in churches; the ceremonial considered appropriate for human kings is everywhere held to be due in a still higher degree on entering the gates of the divine dwelling.

We thus see that bowing and courtesying are the last relics of an old slavish and savage observance; and, though among ourselves they have become in the end mere polite and graceful formalities, they still retain something of their original meaning in the fact that they are specially due from inferiors to superiors and from the younger to the elder, while mitigated by the peculiar fact that men now chivalrously salute women. Englishmen stand and uncover in the presence of

royalty, or when "God save the Queen" is sung or played; servants bow and touch their hats to their masters; soldiers salute their officers respectfully; schoolboys are always rigorously required to "cap" their teachers. On the other hand, our modern American notions of the dignity of manhood, and the touching respect due to women, have largely modified and even altered the sense attached to those antique observances. They are no longer servile; they are courteous and graceful. Equals now bow to one another, not obsequiously, but as an act of self-respecting and reciprocal politeness; the more thoroughly a man recognizes the natural dignity of his own position, the more scrupulous will he be in saluting others with the proper respect due to their personality. The influence of the chivalrous conception of woman has still more profoundly metamorphosed the ceremony of bowing. We raise our hat to a lady, partly as a mark of courtesy to her sex, but partly, too, as a sign of our own politeness and good breeding—a habit that differentiates the gentleman from the boor, the man of education and refinement from the churl and the rustic. In this way, a ceremony that started in slavish submissiveness and savage prostration has grown at last into a distinguishing habit of the polished and civilized modern gentleman. Politeness generally has undergone a similar slow transforming process; it

began with the servile and self-seeking adulation of the great by their inferiors; it has ended with the refined and polished intercourse of equals, who respect themselves and one another, defer mutually in their conversation or arrangements, and so far as possible postpone their own personal convenience to the pleasure and comfort of the society around them. In the East and in all despotic countries, the prevalent politeness is still the politeness of grossly servile flattery. The mild Hindoo habitually describes himself in speaking as "your slave." If you ask him whose horse that is, he answers, "Your Highness'," meaning it is his own, and, like all that belongs to him, absolutely at your service. The phrase "Thy servant" is common in the Bible narratives, as it still is in Syria and Egypt. Self-abasement, real or pretended, before a great man is, in fact, the very root idea of Oriental politeness. In Spain and other parts of Southern Europe much the same extravagant ceremonial expressions still prevail. In taking leave of a friend, you throw yourself (verbally only) at his Excellency's feet; on meeting a lady, you observe that you kiss the señora's hand. But, as we reach the freer, more industrial, and more self-respecting northern countries, we find a genuine consideration for each other's feelings replacing this overwrought and exaggerated verbiage. With ourselves excessive

bowing and scraping are no longer the fashion ; but equals pay to equals and expect from equals an amount of real and genuine politeness which is seldom equalled in the countries where conventional courtesy takes the absurd form of an elaborate and profound servile adulation. In China a man asks his friend, "How are your exalted self and your distinguished wife and noble children? Have you left them well at your palatial mansion?" To which his friend answers politely, "Your poor slaves, my miserable wife and unworthy children, are at their insignificant dwelling, enjoying such health as their character deserves. Your meanest servant is glad to see your eminent presence." In America we say simply, "How do you do?" and the answer is merely, "Pretty well, thank you"; but the real sympathy and friendliness between man and man is a thousand times greater than it can ever be among all the flowery phrases of the Celestial Empire.

XVIII.

ENGLISH CHALK DOWNS.

No form of scenery within the four sea-walls of Britain appears to the American visitor more distinctively and markedly English than that of the chalk downs. Indeed, to all outsiders, chalk is as it were the chief outward and visible sign of the modern British nationality. The stranger who for the first time approaches the shores of England from the opposite continent sees before him in long straight line the "white cliffs of perfidious Albion." That oldest of all names by which the island was known to the outer world is itself of course obviously derived from the white gleaming bluffs which shone so brilliantly in the sunlight to gazers from the high ground about Boulogne and Calais. As one lies in the sunshine by the mouldering ruins of Caligula's tower, on the edge of the port whence the mad tyrant proposed to attack the coasts of Britain, or gazes across the sea from the summit of that purposeless column erected by Napoleon's army of invasion during their forced inactivity in sight of the "perfidious" island, one sees a dim white

wall of chalk upon the northern horizon, lighted up by the full rays of the fronting sun, and stretching from Shakspeare's Cliff, near Dover, to the great steep promontory of Beachy Head, just above Eastbourne. That was the Albion of the early Gaulish merchantmen — that is the Albion that every Continental European still beholds before him as he slowly nears, in ship or steamer, the coast of England. Over and over again around the British Isles, those sheer white walls rise proudly from the sea, as if to defend and guard the approaches to our country from the Continental side. They begin in the tall chalk bluffs of Beer in Devon, the westernmost outlier of the cretaceous system in this corner of Europe; they continue at intervals along the Dorset coast about Weymouth and Lulworth; they form the sharp, jagged summits of the Needles in the Isle of Wight and the grand barrier of the Main Bench in Freshwater Bay; they reappear once more in the Culver Cliffs that gleam across the sea near the entrance to Portsmouth; they rise again on the Marine Parade at Brighton, whence they stretch past Beachy Head with a few breaks and intermissions to Dover; they give origin to the North Foreland and the familiar ledges of the Isle of Thanet; thence they sweep round almost unseen by the Norfolk bulge to the Wolds of Lincolnshire, and finally abut on the German

Ocean in the grand chalk cliffs of Flamborough Head, upon the Yorkshire coast. No wonder, then, that to Continental nations these white walls of the Isle of Albion should always have been regarded as the characteristic feature of the English shore.

Inland the chalk downs cover a very large portion of England, whose peculiar type of undulating scenery is probably unmatched in any other part of the civilized world. The greatest mass of chalk in one continuous belt in the whole of Britain is that which has its centre in the irregular boss of Salisbury Plain, stretching out huge feelers in every direction, towards Dorset and Devon on the one hand, and towards the Chiltern Hills, the North Downs, and the South Downs on the other. It is this mass, of course, lying close to our greatest centre of population and our best-known watering-places, that is most familiar to the majority of Englishmen. The curious way in which its surface is sculptured into long rolling hog's-backs and saucer-shaped combs is so entirely characteristic of the whole formation, and so closely dependent upon the original nature and disposition of the chalk, that, to account for its peculiar hollows and bottoms, we must consider a little the circumstances in which the existing state of things in Southern England has been produced.

Chalk as a whole was laid down at first in one continuous sheet of white mud upon the bed of a great inland sea, a branch of the Atlantic in far distant times, which stretched like an old primeval Mediterranean right across the face of Northern and Central Europe. Soft ooze of almost exactly the same sort is still being deposited in many parts of the Atlantic bottom, whence it has been dredged up, in the yet plastic condition, from the depths of the sea, by the scientific explorers of the *Challenger* expedition and other investigators. This modern chalk, even now growing up before our very eyes, consists chiefly of extremely minute or microscopic shells, composed for the most part of lime which the tiny animals that frame the shells secrete from solution in the sea around them. Fragments of chalk from the cliffs and cuttings of Kent or Sussex, when examined in the powdered state under the microscope, are found to be made up of broken shells, exactly similar to these, each so minute as to be quite invisible to the naked eye, but forming in the mass the entire thickness of our English deposits. In some places the chalk is loosely interstratified with layers of flint, which derive their origin from silicious sponges and other similar creatures which lived in the same seas contemporaneously with the chalk-forming organisms. At first, no doubt, flint and chalk, silicious ooze

and calcareous slime settled down together in a soft and mingled mass of mud ; but gradually, as time went on, the flinty particles collected together into solid veins and lumps, while the whole material was still in the plastic and almost liquid condition, exactly as the sugar in currant jelly often crystallizes out into little nodules, dispersed irregularly through the surrounding mass.

In process of ages the cretaceous sea underwent great changes, and the whole immense layer of chalk, then stretching unbroken over enormous districts of England, France, Holland, and Belgium, came to be overlaid by the newer deposits of the tertiary seas, which once, no doubt, completely covered it in every part. Later still the work of elevation began, and (with many minor vicissitudes which need not here be detailed) Eastern England rose at last above the level of the sea. At that time, without question, the chalk was still unbroken between Dover and Calais. The North Sea and the English Channel had no existence, and the white cliffs of perfidious Albion had not yet begun to be formed and undermined by the encroaching waves. But with the advance of the ages the waters of the Atlantic began their long aggressive movement upon the broad belt of soft chalky strata which then connected the South and East of England with the opposite shore of France and Belgium. Slowly

and gradually, a step at a time, the breakers and the landsprings, acting in concert, wore away the bridge of intervening land, and left the twin cliffs of Dover and Cap Blancnez as the witnesses of the great isthmus that once obviated the necessity for the construction of a Channel Tunnel. To this day the geological strata answer to one another exactly on either side the Straits; and at the narrow point where the German Ocean, advancing southwestward, at last shook hands with the English Channel, advancing northeastward, the correspondence between the two sets of cliffs on each side of the sea suggests at once the idea of a forcible disruption — a breach effected in a solid continent by the continual assaults of winds and waters.

Meanwhile the inland mass of chalk, the last relics of which now form the English downs, had been undergoing no less remarkable and interesting changes. When the southeast coast was first raised above the level of the sea, the entire layer of white chalk — a solid thickness of several hundred feet — must have been covered from end to end by the deep deposits of the tertiary ages. In many places — as, for example, in London and in the eastern counties — these later sediments, the muddy or sandy bottom of some forgotten estuary and ocean, still cover the whole surface of the chalk with a thick layer of superimposed

material. Everybody knows that, if in London you bore deep enough through the clay which there forms the surface stratum of the Thames basin, you come at last upon the pure and virgin-white chalk that lies hidden beneath it. But in many other places — as, for example, along the entire ridge of the North and South Downs — the original capping of clay and sandstone has been completely worn away, and the chalk itself forms the surface of the earth, covered only by a shallow turf of fresh green-sward, through which it is often easy to cut with a knife into the underlying white deposit. The fact is that, during the elevation of England which produced the existing contour of the country, the whole surface was not elevated equally, but was pushed up into ridges along the downs and the Chilterns, while it remained but little elevated along the Thames valley and the Eastern Counties. On the higher portions, dislocated and loosened as they were by the slow action of the upheaving force, the rain and streams were away gradually the overlying clays and sandstones, till they reached at last the naked chalk that lay buried beneath. Nay, in certain spots — as, for example, in the Weald of Kent and Surrey — where the elevating power acted most forcibly, the rain has even slowly worked through the whole thickness of the chalk itself, and exposed

the wealden clays and sands that lie under its bottom. Owing to this extraordinary denuding action, the chalk ceases abruptly at the escarpment of the North Downs, and reappears again only near Brighton, having been worn away over the entire intervening region by the gradual power of the rain and streams. But once upon a time the chalk must have spread uninterruptedly from the one range of downs to the other across what is now the deep valley of the Weald of Sussex.

It is to the same cause that we owe the very peculiar rounded conformation of our existing chalk downs. Indeed, the whole set of actions here described is not something that once took place in the remote past, but something that is still slowly taking place everywhere around us at the present moment. The chalk downs are still being perpetually attacked and disintegrated by the rain, and are still being everywhere unbuilt and lowered and cut back farther and farther before our very faces. Every shower that falls upon the chalk slopes carries down in its drops carbonic acid in solution; and the carbonic acid thus introduced helps to dissolve the lime which forms the chalk, rendering the water excessively "hard," as we say of all water with an excessive quantity of lime dissolved in it. The water and the lime sink together down through the chalk, and come

out below it in the form of springs. That is why chalk assumes such peculiar bossed and rounded forms. Moreover, it gives rise to no rivers or brooks, which cut themselves little valleys or gorges in other strata; it is so porous that the water which falls upon it sinks in at once, carrying down with it small quantities of the lime in solution. Soil seldom forms upon the top; there is nothing to retain it on such rounded slopes; it gets washed away as fast as it grows, and is carried down by the surface drainage into the combes or hollows. These combes represent the parts of the surface where the chalk happened to be originally softest, while the ridges are the harder and more compact places, often protected from the constant waste by layers of flint or concretioned lime-beds.

All the external peculiarities of the downs as we know them nowadays thus depend upon their primitive geological structure and their subsequent sculpture by wind and water. The short turf with which they are covered depends upon the scantiness and shallowness of the soil; and for the same reason trees are rare, growing for the most part only in the combes, or, if on the summit, then generally where old prehistoric earthworks have permitted the accumulation of deeper soil by preventing the constant downward wash which generally takes place upon these

rounded surfaces. Under other conditions there is no depth of soil for the trees to root in ; and so the native vegetation of the downs, appearing wherever they have not been cleared for forming sheep-walks, consists almost exclusively of juniper, yew, gorse, and blackthorn — all of them shrubs that require but little foothold to assist them in fastening on the bare rock. Few or no rivers flow over the chalk, save in the deepest and most basin-like hollows ; elsewhere, as in the country of the Downs and Wolds, the streams that intersect them have long since cut themselves narrow and precipitous gorges in the soft chalk, by which they burst through the barrier ridges. Thus the Thames has carved out for itself the picturesque dale between Mapledurham and Henley, across the Chilterns and the Berkshire Downs ; and thus its tributaries, the Mole and the Wey, have forced their road through the long line that extends across the country from Salisbury Plain to the great white cliffs that overhang Ramsgate. Our southern coast scenery itself has owed its origin to much the same assemblage of circumstances ; here, low tertiary levels slide easily under the bed of the Channel ; there, the end of the Downs topples over precipitously into the sea in a shorn, white cliff ; and yonder, again, the whole thickness of the chalk has been denuded off by the wearing agency of wind and weather, and the

sandstone hills that underlie it have been exposed to the undermining action of the landsprings and billows. Thus the whole of Southeastern England bears everywhere the impress of the white sheet deposited on its surface so many ages since under the forgotten waters of some vaguely limited and long-vanished sea.

XIX.

SPRING BLOSSOMS.

IT is a curious circumstance, which must have struck even the most casual and uninquiring observer of nature that almost all the flowers of early spring are developed from underground bulbs or large tubers. First of all in the floral calendar of the year the snowdrop unfolds its pure white buds to the winds of winter. Almost simultaneously the twin crocuses, golden and purple, send up their exquisite goblet-shaped cups from the little buried globular bulbs that lurk unseen during the remainder of the season beneath the deep mould of the garden border. Scarcely have their delicate heads been beaten down by March winds, or laid low in the draggled mire by gusty showers, when the varied wealth of red and blue and snow-white hyacinths begin to display their scented trusses in the eye of the daily strengthening sun. Next, the daffodils and jonquils gayly flaunt their beauty to the air, and the poet's narcissus, daintiest of all its lovely kind, perfumes the parterres with its luscious odor. Tulips succeed in due order ; and with them come

the pretty cyclamen, the scarlet anemone, and the turban ranunculus with its quaintly striped and spotted buttons. Every one of these, as well as the less familiar winter aconites, white snowflakes, Siberian squills, and blue grape-hyacinths, grows exclusively from bulbs or tubers. Not a single conspicuous ornament of our spring gardens but owes its beauty in like manner to a buried store of garnered nutriment.

If we look abroad to the pretty wild-flowers of English and American fields and meadows, the same curious coincidence is even more strongly forced upon our notice, and the meaning of the facts on which the law depends brought home to us yet more clearly. The brilliant coltsfoot, that bright golden mass of fluffy blossom that often makes gay and beautiful the banks of railway-cuttings in suburban London throughout the chilly days of March and April, springs from a long and stout buried rootstock, and unfolds its leafless head naked to the breezes, being followed only after long weeks of interval by the large and stately spreading foliage. So too with the American hepatica and bloodroot. The lesser celandine, a low but beautiful species of the buttercup genus that spangles the meadows with its golden stars long before any other conspicuous flower has begun to open in the English fields, possesses innumerable tiny round tubers on its roots, which

have given it its common local names of pillwort and pilewort. The Lent lilies, now so commonly sold in great bunches about the streets of London — since the “æsthetic” reformers brought English wild-flowers for a while into fashion — are the uncultivated form of the native daffodil, and grow, like all their tribe, from deeply rooted bulbous bases. The American yellow lilies are of like habit. The common arum, known to village children by its quaint old-fashioned name of lords-and-ladies, and to country-folk generally by the still quainter and older title of cuckoo-pint, has a thick and succulent buried rootstock so richly stored with an abundant stock of hoarded nutriment that it used in former days to be dug up on the Isle of Portland for the sake of the starch it contained, which was sold to poor consumers as Portland arrowroot. Similarly, the little yellow bulbous buttercup is the first of all our true buttercups to unfold its golden petals to the sun; while the almost indistinguishable meadow buttercup, discriminated from it in the blossom only by botanical eyes, flowers a full month or six weeks later, because it has no bulb or tuber from which to derive a store of ready-made material.

The rationale of this almost universal bulbous habit among early spring flowers hardly needs to be pointed out to the intelligent observer of the external world. Leaves, as everybody now knows,

are the real mouths and stomachs and digestive organs of the vegetable economy. The business of the root, which most people used to imagine was entirely intended for sucking up the nutriment of the plant, consists really for the most part in the mere subordinate function of water-supply. The real raw material of leaf and stem and flower and fruit is ultimately derived from the carbonic acid diffused in the gaseous condition through the surrounding atmosphere. If this seems at first sight a hard saying, we have only to remember the familiar yet crucial instance of a hyacinth grown in a glass vase filled with water. Here it is quite clear, even to the most unscientific mind, that the roots, which descend into the glass, can supply the plant with nothing more than the water they float in. It is the work of the leaves to extract the solid particles of carbon from the air around and to build them up with oxygen, hydrogen, and nitrogen into the starches and the active living principles which ultimately compose the entire plant. Exactly the same sort of evidence is afforded by the common cottage practice of growing mustard-and-cress in a saucer upon a small piece of wetted flannel. It is quite evident in such a case that the rootlets of the cress supply the growing seedlings only with the water which they absorb from the flannel on which they creep, while the entire work of collecting material for

the growth of the plant is handed over to the green leaves in the open sunlight. In fact, the sole use of roots is to supply the leaves with proper moisture, and with the very small quantity of mineral matter and nitrogen compounds which the plant requires for its full development. The main work of feeding the whole herb is carried on by the green foliage.

This being so, it is easy enough to see that plants are entirely dependent for support upon their green leaves. During the summer-time these leaves, expanded freely to the warm sun, are perpetually engaged in manufacturing starches and other raw materials for the future growth of the whole vegetable system. To the outer eye, the plant appears a stationary, motionless, and almost lifeless thing; but, if we could but watch with a microscopic vision its unceasing processes of change and development, we should see that it is in reality a strange and busy natural laboratory, where endless curious operations are for ever taking place with marvellous rapidity in every direction. The sap is circulating and moving ceaselessly from cell to cell; the green material in the exposed surface is busily assimilating particles of carbon from the surrounding air; the root is supplying water and small quantities of other necessary materials; the digestive organs are working up the whole by some subtle chemistry

into the future elements of fruit and flower and seed and woody tissue. What looks to us a mere inert and lifeless expanse of green matter is in reality a living theatre of the most varied activities. Chief amongst them all are the manufacture and storing away of the raw material which must ultimately be used up in the final production of the beautiful blossoms, and of the useful fruit and necessary seed for whose benefit they really exist.

Now, annual plants sprout from the seed in the first days of spring, or even in the sunniest winter weather; but, before they can lay up enough material to supply the wants of the flower and the fruit, they must form a considerable number of healthy leaves, and raise their stem to a reasonable height above the surrounding ground from which they have sprouted. This of course requires a moderate lapse of time for its proper accomplishment. And so every amateur gardener must have noticed for himself that annuals never in any case supply the earliest spring or summer flowers. For the most part they do not begin to blossom freely before June or July, while many of the larger ones, like sunflowers and thorn-apples, scarcely manage to come into full bloom before the middle of August or September. It is the perennials that afford us all our early blossoming garden favorites, and that deck the beds with crimson, orange, pink, and yellow before the winds

of March have yet subsided or the showers of April have ceased from falling. The hardy wall-flowers that brighten the crannies of the rockery as early as the golden crocuses themselves appear above the neighboring beds, the white arabis, the purple stocks, and the few other practically ever-green plants that preserve their foliage unchanged through the winter, are all perennials, and all owe their early blooming season to the fact that their leaves never drop, but go on laying up material for flowers even in the very midst of a northern winter.

But, among perennials themselves, the ones that send up the showiest blossoms in the first days of returning spring belong almost all to the special class which have learned to provide for an early flowering season by laying by a rich stock of material beforehand in a bulb or tuber. It is thus alone that they can manage to produce a handsome show before the foliage of the year has begun to expand its myriad mouths to the sun and the atmosphere. And for this reason it is rather noticeable that a great many early spring flowers unfold their buds either quite naked and leafless, like coltsfoot and winter aconite, or while the leaves are still very small and hardly showing above the ground, as is the case with the crocus and the snowdrop. The plant lays by starch and other nutriment in the bulb or tuber during the

preceding year. Even the very flower-buds themselves are already present in a very simple rudimentary shape ; and, as soon as the warm weather begins to return, the heads of blossom push their way up boldly through the soil, relying for material to supply their growth on the bulb beneath them. As soon as the flowering season is over, the old bulb becomes empty and flaccid ; it has been drained of the starches by the opening flowers ; and then the leaves of the new year begin to form a second bulb for the next season, storing it afresh with yet another granary of starch and similar food-stuffs. This flaccid condition of the used-up bulb is particularly well seen in hyacinths grown in the common colored glass specimen vases. A bulb, in short, is simply a means of storing up nutriment one season for the supply of the plant during the early months of the next succeeding one.

Almost the only very early spring flowers which do not thus depend for nourishment upon bulbs or tubers are those of shrubs and trees ; and even here the underlying difference is rather apparent than real ; for in woody plants the starches and other useful materials of growth are stored up in the branches and stem, just as they are stored up in underground bulbs or tubers by the more soft and succulent herbs like daffodils and lilies. Thus in the very coldest months of winter the yellow

jasmine blossoms freely in the open air at a time when all its leaves are shed, so that only the pretty golden flowers themselves star the surface of the naked branches. Gorse, that most irrepressible of English flowering shrubs, never ceases in the same way to bloom spasmodically throughout the entire winter, though in this case the leaves are ever-green and capable of withstanding the severest frosts. In *laurustinus*, again, the foliage never drops; and so leaves and flowers appear together in the first days of early spring-tide. But the pretty and curious little pink mezereon follows rather the custom of the yellow jasmine, and unfolds its delicate blossoms to the air before the tiny rosettes of green leaves have begun to show at the stiff summits of the hard little branches. Flowering almond follows the same course; and so to a greater or less extent do the cherry-blossom, the *pyrus japonica*, the pear, and the apple. All alike derive the material for the unfolding flowers from the store laid by in the previous year among the permanent tissues of the branch on which they grow.

In either case, whether the particular blossom springs from a bulb or from the branches of a tree or shrub, the conspicuous spring flowers are visited by bees, which aid in fertilizing them and setting their seed. If there were no bees in winter, there would be no winter flowers; for the blossoms

open only in order to attract these winged visitors, to whom they owe their due impregnation. But, if one watches, say, a yellow jasmine or a bush of gorse on a sunny morning in the very coldest months of the whole year, no very long time will ever be found to elapse before a bee appears upon the scene with extended proboscis, eager to rifle the freshly opened flowers of their honeyed store. It is for this reason that the plants bloom at such an apparently inclement and unsuitable season. They want to attract the stray bees, whose attention they secure more easily at such a time than in the late summer, when so many other competitors are striving to gain a portion of their useful services. On the other hand, it is equally desirable for the bees — especially wild ones — that there should be some such winter-flowering plants, because they need honey all the year round, and fly about in the very depths of winter on every bright and sunny day. Hence there is really not a single absolutely flowerless month throughout the whole year in our northern climates. The bee begins his floral calendar with gorse and aconite and jasmine in January, and continues the succession of his honey-bearing blossoms all the year round till he ends with camomile and daisies and Christmas roses in late December. It is a balanced system of mutual accommodation. The flowers supply the hungry bee with fresh relays of

honey through all the months, and the bee contracts to act in return as carrier of pollen and chief fertilizer to all his food-plants from season to season. Thus the double end of nature is secured, and each great division of life ministers to the other in due succession.

XX.

THE EARTH'S INTERIOR.

FROM a very early period, in all probability, man's curiosity, ever awake to every form of mystery, has been much exercised as to the solid ground that lay beneath his feet, unexplored and unexplorable. What supported it, and how did it get there? In ancient Hindoo fable the world is said to have been upheld on a gigantic elephant and the elephant again to have been lifted on the back of a huge tortoise. But what supported the tortoise that supported the elephant that supported the world, Hindoo mythology did not either deign or venture to speculate. Probably that titanic reptile was conceived of by his inventors as floating on the waters with which popular imagination has at all times filled the interior of our planet. So long indeed as the earth was regarded as a flat plain — as it is still considered to be by a few unscientific and half-insane enthusiasts — there was a certain show of evidence forthcoming for the crude idea that its lower depths were composed of water. Wherever men sank a well, if only they dug deep enough, they were almost sure to

hit at last upon some spring or other, running through a vein in the lower strata. Hence the conception of "the waters that are under the earth," admitted as a mere current expression into the text of Scripture — much as other current expressions, like "sunrise" and "sunset," have been similarly admitted into the same text — came to have a wide vogue, and to be regarded as possessing some sort or shadow of scientific importance. In reality, of course, the water that rises more or less in wells is merely the same which fell as rain on the adjacent country, or on neighboring hill-tops, and which, after sinking in and finding its level downward, is tapped somewhere at a point below its highest surface, so as to fill a well, or even, in certain circumstances, to rise as a free spring or fountain to the top of the boring. But the total amount of water thus existing in a free condition within the earth's body at any given time must be but a mere insignificant fraction; the vastly greater part of the whole sum on the face of the earth must always be that collected in our oceans, seas, lakes, and rivers.

As soon, however, as the true position of our earth in the solar system came to be generally recognized by scientific thinkers, it became clear at once that the notion of an aqueous interior could not for a moment be accepted as possible; to use a convenient and appropriate colloquialism,

the idea would not hold water. A globe of solid rock reposing upon a light watery nucleus is a clearly impossible physical conception — the crust would have to sink to the centre under the influence of gravity, exactly as a stone in the same circumstances sinks to the bottom of a sea or river. One might as well expect to find rocky islets floating on the sea, as continents and the whole solid shell of earth floating idly upon an aqueous centre. At the same time a good many causes began to lead men to suspect that the interior of the earth possesses a far higher temperature than the cooled and solid surface. It is known that, when we dig deep below the level of the soil, as in mines or well-boring, the thermometer rises higher and higher in a fixed proportion according to the depth to which we have penetrated. Pushing this calculation to its logical conclusion, it was soon suggested that at four or five miles below the surface the temperature must rise to something like white heat; we must imagine the earth to possess a fiery core, surrounded by a cooling, solidifying exterior. Again, the existence of volcanoes, geysers, and hot springs, all coming evidently from within the bowels of our planet, and all apparently bearing witness to a very hot and igneous origin, supported the same rising theory. Once more, it was plausibly argued that pressure by itself produces heat; and

the enormous pressure of millions upon millions of tons of solid rock, and square miles upon miles of profound ocean, must alone suffice to account for a gradual increase of temperature at every few hundred yards we dig down into the earth's interior. On these and many other similar grounds, such as the evidence of the igneous origin of granite and of many other extruded rocks, it was fairly concluded among men of science that the earth's core must be regarded as in a high state of white heat. The rocks that most often underlie all the others, or that have been poured upward and outward through all the others, came up at first as molten masses, it was reasonable to conclude that the other rocks which still form the solid centre were even now in a like condition of melting heat — were, in fact, one vast and motionless internal sea of liquid fire, a genuine volcanic Mediterranean.

When first astronomy began to busy itself seriously with the origin and history of our sun and his family, this idea of the molten centre gained ground still further every day, because of its apparently strict accordance with all that was otherwise known or conjectured of the solar system. Every sun and every planet, according to the luminous views of Kant and Laplace, started in life as a condensing haze-cloud, a mere scattered mass of very thin and perhaps gaseous material,

gradually gathering around a central point. But, as the atoms of which it was composed fell together towards their common centre, under the influence of gravitation, their mutual impact heated them to a white heat just as a piece of cold iron on a blacksmith's anvil is often heated red-hot by continued blows from the heavy hammer. In its earlier stages, therefore, every world must have passed through a fiery and stormy youth; and as it grew older, it must have grown colder, on the outside, at least, by the constant radiation of its surface-heat. A poker raised to a ruddy glow in the fire—to take a domestic analogy familiar to every one—cools slowly as soon as it is removed from the burning coals, but the outside grows cold before the inside, and in a large mass, such as a solid cannon-ball, the difference of temperature between surface and centre may sometimes be very marked and conspicuous. Some of the planets, as we know by the evidence of the telescope, are still in their primitive heated condition; the fires of their youth have not yet burnt themselves out, and they have not yet settled themselves down, like our own earth, to a sober, staid, and respectable middle age. Passionate storms still shake them violently to their very core, and nebulous vapors hide their faces from us with a fiery mist. Geology shows us that our own earth—that solid earth upon whose stability,

in spite of occasional earthquakes and volcanic eruptions, the inhabitants of this peaceful and easy-going planet so greatly pride themselves, once passed, for its own part, through a similar stage of molten rock, and only slowly settled down, like all the rest of us, into a placid, calm, and respected old age. It was natural to conclude, therefore, that the earth's interior consisted really still of liquid fire, and that the solid crust, which composes to most of us all that we ever think of as the world, was the cooled surface of an internally igneous and distracted mass. We walk, said geologists, with perfect confidence, and, on the whole, justly so, upon the thin and quivering caked exterior of an indescribably hot and molten globe. A few miles of hardened outside, at best, divide us from a vast core of unspeakable fire ten thousand times hotter than the hottest furnace. And that the seething mass thus pictured as the earth's main body was really liquid, a tremendous sea of white hot molten material, was until lately the almost universal belief, expressed or implied, of all the greatest and most learned geologists.

Still later, however, new trains of physical reasoning were brought to bear upon the correction and rectification of this somewhat crude and unfixed idea. For if the earth's molten centre were really liquid, how was it, people asked, that the solid crust was able to float upon it, instead

of sinking through it? Consider the vast extent of the pressure exercised by whole solid square miles of rock and mountain superimposed upon a liquid central body. Could any one believe for a moment that even a single mountain, much less a whole hemisphere, could be so supported upon a sea of liquid? This vast weight forever pressing down upon the hot interior must surely reduce it, however high its temperature, to the condition of a solid, by mere force of gravity and condensation. You can press a gas till it assumes the form first of a liquid and then of a solid; you can reduce carbonic acid itself, which looks and feels as thin as air, first to the condition of a body like water, and then to a solid resembling ice. If the mere slight pressure which man's mechanical appliances enable him to effect can produce such solidifying results as this, what are we to believe must be done by the crushing weight of whole seas and continents, hemispheres and oceans, piled on top of the supposed fiery Mediterranean? No; the idea of a liquid centre to the earth becomes clearly impossible when viewed in the rational light of modern physics; however great the original heat due to the falling together of the earth's atoms, and that due to the pressure itself, the centre cannot even so be regarded as liquid; it must be squeezed solid by the enormous mass of mountains and seas imposed on top of it, with their incalcu-

lable weight. Hence the last word of modern science on the existing condition of our earth's centre seems to be just this; our planet consists of a cool and fairly solid but lighter crust poised upon the top of a very rigid, hard, and immensely hot core, which would be liquid and molten, but for the unspeakable pressure of the thick crust piled heavily above it.

It is a great comfort to think that, after all — at least as far as science has yet gone — we need not give up the solid earth which we all flatter ourselves is so safe and secure beneath our feet. True, science, like the world itself, is always moving, and it has an awkward habit, in all these abstruse matters, of unsaying to-morrow what it told us yesterday. Just as we are beginning to think we have really learnt its last lesson quite correctly, it comes upon us unawares with some strange and contradictory fresh solution, upsetting all the ideas we have been one moment before congratulating ourselves upon having fairly mastered. But for the present, at least, we may go to sleep in comfort, as men still do upon the flanks of a volcano, consoling ourselves with the reassuring thought that if our planet is all one fiery mass within, it is, at least, of solid, not of liquid fire. And, indeed, this conclusion, like most other final conclusions, has a great concinnity and neatness about it. For, if we regard the world as a whole,

we shall see that the lightest materials in its composition are just where we should expect them to be — on the outside — and the heaviest, on the other hand, are just where we might naturally look to find them — at the bottom and near the earth's centre. On the very exterior of all, surrounding our globe like a thick but light envelope, comes a deep layer of gaseous matter, the air or atmosphere, thinner and lighter as we rise towards the top, on mountain-summits or in an inflated balloon, and denser and heavier near the solid surface or at sea-level. Next to this outer gaseous coat comes a more partial envelope, the water of the ocean, collected into the profounder hollows of the crust, heavier than the air, but lighter than the rocks and soil which form the solid tertiary layer. This solid tertiary layer itself, we may conclude, is, in the same way, lighter and less dense than the yet deeper inside; for, when the whole mass was still liquid and molten, and the ocean existed only on its face in the shadowy form of steam or vapor, it is natural to suppose that the heavier materials, such as lead and mercury, would sink, for the most part, steadily towards the centre, under the influence of gravitation, while the lighter, which compose in the main the existing crust — largely silicious in character — would float on top like oil on water. Thus, we get a clear mental picture of our earth as a solid,

rigid, cooling body, with a crust occasionally collapsing upon the shrinking centre, but on the whole progressively more hard as we move from the the known and knowable outside toward the unknown core. And, whether this conception be wholly and fully correct or otherwise, it is at least some consolation to reflect that we shall never in all probability get any experimental proof to the contrary. That is the best of all such cosmical speculations; if you are wrong, you have, at any rate, the comfort of feeling that nobody else can be much wiser. Volcanoes and earthquakes may help us to arrive gradually at fuller conceptions upon this abstruse point. The constant observation of Vesuvius and Etna, the examination of extinct ancient craters, and even the result of spectroscopic analysis in other stars, may also assist us in coming hereafter to a final conclusion. But, on the whole, it is at least probable that we shall never know, with absolute certainty, the exact constitution of the earth's centre. And yet "never" is a long word. Now that we are beginning to analyze the sun, and to determine the component elements of the distant haze-clouds, it is not perhaps too much to expect that we may some day decide the difficult problem of the earth's interior.

XXI.

NUTS AND NUTTING.

IN all the hedge-rows and copses of England the nutting season is now in full swing. While the lasses with their wicket baskets are busily picking blackberries for market, or for the domestic preserving-pot, the lads are scrambling up banks at the risk of their necks after Kentish filberts, or flinging stones recklessly at the landlord's trees for the great husky Spanish chestnuts. The filberts are mostly too precious to be eaten by the finders in person — they are sold for the dessert of richer people; but the common beechnuts have no economical value, as the daily papers put it; they are the natural prize of the small boy who first lights upon them, and they are enjoyed with quite as much gusto by the young discoverer as the daintiest nuts on earth in wealthier households. You have to hunt a good deal before you get your reward in the beechnut industry; half the husks are empty, or contain only sterile seeds, and it is not more than one or two fruits in a dozen that one can really eat with any internal satisfaction. But the taste of boys is easily sat-

isfied, and beechnuts probably afford as much pleasure to the human race in modern England as all the costly peaches, apricots, and nectarines in the whole country put together.

It is a very noticeable fact about these, our English nuts, native or acclimatized, that they have in every case a prickly or else a bitter and disagreeable outer covering. Filberts, as we all know, are enclosed in a ragged-edged, green envelope, which turns brown as they ripen, and which is defensively armed with tiny hair-like prickles, extremely close-set over its whole surface. These prickles are annoying enough, even to our hard human fingers, in certain stages of their existence, and almost everybody has noticed that to pick green filberts is a very disagreeable or even painful operation. But the filbert is armed not so much against the depredations of boys and men as against the obtrusive little teeth of dormice and squirrels. Now, these animals have to bite a hole through the filbert in order to get at it, and the prickly hairs upon its surface are intended, to a great extent, as protective against such tiny woodland enemies. The soft bare skin on a dormouse's nose is easily irritated by the stinging bristles, which only penetrate deeper and deeper in proportion as the creature rubs its snout against the branches of the tree in order to get rid of them. Nevertheless, dormice

live almost entirely upon cob-nuts, and manage to outwit the hazels by getting at them through the open end as they grow upon the boughs. Very often the cunning creatures remove the whole inside of the nut without loosening it at all from the husky envelope.

The nuthatch, that most persistent of British birds, is also a great foe to the peace of mind of the filbert-tree. Hazels and nuthatches, in fact, may be regarded as pre-established enemies, like rabbits and ferrets, or hawks and sparrows. But a far more dreaded creature than any of these to the filbert is the common nut-grub, who makes his attack in a more insidious manner, entering the nut as an egg while it is yet green and soft, and slowly eating out its centre before it has time to arrive at weeks of maturity. It is partly as a protection against the nut-grub and his intrusive mother, no doubt, that the hazel has armed its young nuts with the jagged covering and the close armor of defensive hairs.

It is just the same with all our other British nuts; they are each protected in like manner against the probable depredations of their most indefatigable hereditary foes. The prickly outer rind of the chestnut, for example, enclosing the brown nuts in its green coat, serves to keep off the squirrels to some extent — at least, so far as to allow the tree to seed sufficiently. The beech

has a very similar prickly covering to its small triangular fruits; while in the walnut the bitter juice of the outer rind is quite nasty enough to deter at once any intending animal foe. In the horse-chestnut, not only is the outside shell prickly, but the actual kernel itself is also intensely bitter, and slightly poisonous; and in the acorn the mere bitterness of the nut seems almost sufficient to protect it from serious injury, without the need for any external armor at all. Even here, however, the little scaly cup that fits upon the softest and most vulnerable portion of the shell is evidently meant as a piece of defensive mail against the attacks of the ubiquitous grubs.

But why are nuts provided with these defences against animal invasion? Why are they coated in hard shells, or covered with prickly rinds, or enclosed in bitter envelopes, or insured against attack by coats of scaly mail? Are they not, in fact, intended as food for the squirrels, and dormice, and nuthatches, and pigs, if not even for the ugly little grubs and burrowing worms themselves? What is the use of thus protecting them against the very creatures whose natural food they seem intended to provide? Well, the answer all depends upon which point of view you happen to take, that of the tree or that of the squirrel. We lordly human beings, as we are ourselves confirmed nut-eaters, sympathize rather with the aggressive

animal. But the plant has its own ideas upon the subject, too; or, to speak more correctly, it has been provided with means of defence for itself in very much the same fashion as if it were really an animated being, capable of looking after its own interests and protecting its young seedlings. Let us look for a moment at the matter from the point of view of the oak or the hazel, and consider why it is necessary that their nuts should thus be protected from the persistent attacks of their hereditary foes.

To us, as to the squirrels and dormice, a nut is merely a nut — that is to say, a toothsome morsel, to be husked, cracked, eaten, and, in due time, properly digested, for our own use and gratification only. But to the tree on which it grows it is something far more interesting and important than that. It is a seed, the predestined ancestor of future generations of nuts, and the hope of the species throughout all prospective ages. It has to hand down all the qualities and properties of the parent-stock to the young seedlings that are to come after it. Now, seeds of all sorts are in perpetual danger of being eaten, and so destroyed; and it is the great aim of the plant, so to speak, to prevent them from suffering this ignominious fate, just as it is the great aim of the parent bird to keep its eggs from being devoured by snakes or stolen by boys, and just as it is the great aim of

the parent animal to preserve its young from being destroyed by their natural devourers. When man uses a seed for food, as in the case of wheat or pease, he more than repays the plant that bears it by keeping some for sowing, and by planting it in the best prepared soil under the most propitious circumstances. But the lower animals are not so provident. If left entirely to themselves, they would eat up every seed of the plant on which they live, and so exterminate the very species upon which they depend for support. Doubtless, this result does now and again happen in the infinite changes and chances of nature, and then both plant and animal must necessarily disappear, to join the long and ever-increasing roll of extinct species.

As a rule, a certain number of seeds always survive, no matter how much they may be persecuted by animals; and it is these seeds that become the parents of the trees or plants of the next generation, handing down to them their own individual peculiarities. Of course, the larger and richer the seeds are, the more likely are they to be eaten, and the more will they stand in need of some external protection to guard them against the attacks of their animal foes. Now, a nut is merely the name we give to an exceptionally large and rich seed; and nuts are noticeable for the immense number of protections which they have

accordingly acquired against the sharp teeth of mice and squirrels and other animals, as well as against certain birds and the larvæ of insects. In this respect nuts differ greatly from true fruits, in the popular sense of the word. For a fruit — for example, a plum or a peach — is a seed-vessel of which we eat the outer pulp, husk, or rind; but we throw away the actual seed or kernel, the part from which the young tree is destined to be produced. As a rule, too, even in fruits, the seed itself is more or less carefully protected. Thus, in the peach, the kernel is enclosed in a very solid wrinkled shell; in the apple, the pips are surrounded for safety by a leathery central sack, the core; and in the orange they are not only covered by a hard skin, but are also themselves intensely bitter and extremely nasty. So that even in pulpy fruits we are always more or less prevented from swallowing, or at any rate from digesting, the true seeds, pips, or kernels.

Nuts, however, are fruits in which the eatable part is not the husk, pulp, or outer coat, but the true seed itself, the hope and stay of all future nutty generations. Hence it becomes very important for these large and rich seeds to be efficiently guarded against animal depredators. In the tropics, where monkeys abound, it is needful for the nuts to withstand in some cases, at least, those cunning and active little animals, which are

able not merely to pick them with their hands and crack them with their teeth, but even to use a large stone as a hammer to force them open. For this reason, in tropical countries we find some trees, like the cocoa-nut palm, which produce extremely large and hard nuts sufficient to baffle in many cases the clever monkeys themselves. Yet even the cocoa-nuts are rifled by the cocoa-nut crab, who inserts his pincers through one of the three holes or pores at the top of the nut, and slowly extracts the nutritious kernel piecemeal. There are other tropical kinds, such as the Brazil nut, which have a double shell, the outer one being large and round, like the cocoa-nut, and enclosing within it the smaller roughly triangular nuts with whose irregular shapes we are all so familiar on our own dinner-tables. The queer corners of the Brazil nuts are of course due to their being all squeezed up against one another as they grow inside the large surrounding outer shell. The toucans and hornbills, the huge fruit-bats, the opossums, and the numerous big tropical squirrels have all, no doubt, borne their own subsidiary part in the development of the large and hard-shelled southern nuts. For, as only the nuts that do not get cracked can survive to grow up into trees from one generation to another, all the softer forms get quickly weeded out by the constant selective action of the nut-eating animals,

and none but the hardest succeed in peacefully germinating into young palms or nut-bearing trees.

Our English nuts all display the characteristic signs of nuts in general to a somewhat less marked extent, but still very noticeably. While most fruits are brightly colored, as if on purpose to attract the animals by whose aid they are finally dispersed, most nuts are green as long as they remain upon the tree, so as to escape notice among the surrounding foliage, and brown as soon as they are ripe enough to fall, so as to harmonize with the faded leaves and dry grass and dying bracken underneath. For, just as it is advantageous to the fruit to be eaten, in order that its seed may be more surely sown away from the shade of the parent tree, so it is advantageous to the nut to escape notice and not to be eaten, since to eat it is to destroy the seed which the tree has produced as a future plant of its own species. It is for this protective purpose that the walnut possesses its bitter and nauseous husk, enclosing its solid shell; so that not one walnut out of ten can be got at by the little gnawing animals who perpetually compass its destruction. It is for this purpose that the chestnut has acquired its prickly coat, and the filbert its unpleasantly hairy envelope. And, further to guard against the depredations of insects in particular, the inner ker-

nel of many of these nuts is enclosed in a brown or scaly skin, which in the fresh walnut is quite disagreeable enough even to man to make it worth while for us to peel our walnuts before eating them. The similar inner coat of the almond is familiar to all of us; and we usually look upon it merely as a sort of accidental disfigurement, put there in order to be cleared away with hot water before the clean white almonds are mixed with raisins for our English dessert-tables. In reality, it is there in order to preserve the almond from the little worm whom we sometimes find to our chagrin inside the husk of a damaged specimen. We forgot too often, in our blind human fashion, that the primary purpose of all these nuts is to serve as seeds for their own trees; that of serving as food for man and other animals, though no doubt the most important from our own personal point of view, is, after all, in the scheme of Nature, nothing more than a secondary and derivative one. Before man was created at all, the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind. The first use of the seed is as a seed; its use as grain or food-stuff is secondary only.

XXII.

AMUSEMENTS.

“LIFE,” said a genial but cynical thinker, with equal wit and wisdom, “would be really quite endurable if it were not for its amusements.” How many of us, in middle age at least, have, after our own humble fashion, come to exactly the same easy-going conclusion ! As long as we are allowed to pursue the even tenor of our way unmolested, to rise in the morning to our accustomed tub, to go through our sober round of wonted duties, to dine off our leg of mutton and apple-pudding at our own unpretending domestic table, to enjoy our evening pipe, or our quiet chat over the knitting and the work-basket, and to go to bed decorously at half-past ten, we are, in our peaceful, uneventful fashion, perfectly happy and contented. But, when the boys and girls — those reckless disturbers of domestic bliss ! — insist upon dragging us off for a month or so into comfortless lodgings by the seaside, or pulling us by both arms to the inhospitable summit of Mount Washington, or carrying us down by sheer force to hear a weeping melodrama or a screaming burlesque at the

Ambiguities Theatre, we feel in our hearts that this is too much, and that we can get along very well indeed nowadays without amusements. The ex-Khedive of Egypt, to be sure — if report speaks true — was a sensible though somewhat luxurious man who knew how to combine middle-aged comfort and youthful love of excitement in a lordly fashion only possible to an Oriental despot. He had his theatre built just next door to his drawing-room, and that again to his dining-room ; and the players — or artistes, as we ought to call them nowadays — were compelled to hold themselves always in readiness after dinner, in case his Highness should wish to listen to the drama or the opera. As soon as dessert was finished, the luxurious Viceroy would stroll carelessly into the adjoining apartment, compose himself peacefully in his easy-chair, light his cigarette to promote digestion, and give the word to one of his attendants, “Let us have some Offenbach !” In ten minutes the curtain which formed one side of the saloon would rise upon the Grand Duchess of Gerolstein, and the Khedive would sit solitary, or surrounded only by his suite, watching the progress of the whole piece from the comfortable cushions of his own arm-chair. That was a princely Eastern way of taking one’s amusements quietly, and not to be easily compassed in our Western societies. Whether the actors and actresses found this sort

of one-man audience inspiring and encouraging to their professional efforts is of course quite another matter.

But for the respectable middle-aged citizen or citizeness in these modern States of America to get up after tea or dinner, as the case may be, and go off seeking amusement at any of the recognized establishments supposed to purvey that commodity to our towns and cities, is really too preposterous and serious an undertaking. If you belong to the wealthier class which dines sumptuously at seven every day, you have to rush away from your claret and your peaches, leaving your dinner half digested, and drive down in hot haste to the centre of town, just in time to find the second act half finished as you enter the theatre. If, on the other hand, you belong to the far larger body of American citizens which takes its tea at half-past five, and looks forward to a light supper at the end of the evening's entertainment, you have to wait about for an hour before the portico until the doors open, and then take your chance of getting in with the rush in that great scramble for places where might is still right, and where the hindmost is still devoted by popular politeness to an unmentionable personage. These things are all very well in their way while one is yet sweet one-and-twenty; but, as time begins to grizzle the beard, and faint lines pucker up the once smooth

and unclouded forehead, middle-aged man has his nascent doubts as to whether, after all, the game is now really worth the candle. He finds it harder and harder to tear himself away from home; the attraction grows weaker and weaker, as the scientific men would put it, while the resistance to be overcome grows greater and greater with every winter. A dance used to be a delightful thing indeed before one was married, and when one had a chance of meeting Amelia there for half an hour; but, now that one sees Amelia every day from morning to night, and goes to the dance only for the sake of one's daughters, why, the amusement of the thing is not somehow quite so apparent as it used to be some twenty years ago!

On the other hand, maturer age undoubtedly gives quite as much as it takes away, even in this very matter of amusements. While we are young, we go out of our way too much to get ourselves amused; we are always seeking out pleasure and excitement, always trying to find some fresh opportunity of agreeable stimulation. But it is a well known observation that the more directly we aim at pleasure, the more does pleasure seem to flit and evade us. She is a coquette, that flies if you pursue, but coyly seeks you if you pay her scant attention. This is a truth that middle age alone begins thoroughly to appreciate. The best amusements are those that come of themselves, as

it were — those that obtrude themselves upon us, and grow on us slowly as the years grow fleeter. Youth is always in a hurry to enjoy itself; it wants to find out a thousand new forms of amusement, to exhaust the whole repertory of nature at a single sitting. It must have balls, dances, picnics, lawn-tennis, theatres, operas, entertainments, concerts; it must go to Newport and Saratoga, Long Branch or Coney Island, as its tastes or its means permit it. Youth must live forever in a constant whirl of excitement; it must boat, hunt, shoot, fish; it must travel, it must hurry, it must scurry, it must whirl; whatever it does, it must never vegetate. It loves excursions, great gatherings, books, life, movement, the rapid joy of eventful existence. All meditative amusements it votes “slow,” and finds boring. If it goes to the seaside, it demands, not quiet and relaxation, not sea and sky and sails and sea-gulls, but a crowded promenade, a pier where the band discourses lively music, and a stretch of yellow sands covered with bathing-machines, nursemaids, minstrels, hired donkeys, and toy goat-carriages. Like Blanche Amory, it requires emotions. Nothing but life will satisfy it; and by life it means noise, bustle, gayety, and visible crowds of like-minded humanity.

Middle age, on the contrary, has learned to reap the harvest of a quiet eye from many things which

youth passes by, with supercilious contempt or silent inattention. Fields and trees have grown more dear to it. A cathedral can afford the middle-aged mind far more real and lasting pleasure than any amount of gayety used to do in earlier years of feverish excitement. A stroll through a country lane acquires fresh powers of interesting us with every added summer; a holiday spent peacefully by lonely sea or untrodden mountain reveals unexpected faculties of enjoyment in ourselves with every recurring season. We find the world less exciting than of old, it is true, but more beautiful and more interesting each year as we pass the line of thirty; we pitch our hopes lower, and we discover that they are more often fairly realized. We do not go out of our way so much to seek amusement; and, behold, amusement comes out of her way to seek us! The flowers in the garden have almost as much plot-interest for us as a good novel; the colors on the clouds please us quite as well as the Salon and the Academy; the drama of life worked out by our friends and our children has tragedy and comedy in it sufficient to keep us fully occupied without such frequent visits to the mimic theatre. We stay at home more, and find in books and conversation and household duties a calm pleasure that we could not have appreciated in our noisier and more rackety younger existence. Life grows

grayer, some people think, as forty approaches. Nay, not so ; it grows calmer and more peaceable ; and at the same time it grows more unselfish.

Thinking less about ourselves, we learn to think more about other people ; our pleasures come to lie more and more in giving pleasure to those around us. When we look forward to a holiday, we look forward no longer to the delights we are ourselves to experience, but to the delight of giving the boys a ride over the grassy hills and taking the girls to the Christmas pantomime. Those are pleasures of which it is harder to rob us, and which we could not have appreciated so much in the old days when Plancus was consul.

Moreover, it is incidental to the active pursuit of pleasure that, when we aim at it too directly, we feel always the bitterness of disappointment, and so become cynical and complaining. It is young men and young women who write all the Byronic poetry of blighted hopes and blasted aspirations ; it is very young people who discover that existence is a mistake, and that the true function of the poet is to write threnodies. "Life," said the American boy on his tenth birthday, "isn't all that it's cracked up to be." "The world is hollow," says the little girl-pessimist in *Punch*, "and my doll is stuffed with sawdust." That is the natural reaction from a view of life which considers that it ought all to be made up of excit-

ing adventures — as the American humorist puts it, “of beer and skittles.” Maturer age can afford to do without these romantic sorrows. As Mr. Andrew Lang, the poet of calmer years, amusingly writes : —

Oh, foolish youth, untimely wise!
Oh, phantoms of the sickly mind!
What? Not content with seas and skies,
With rainy clouds and southern wind,
With common cares and faces kind,
With pains and joys each morning brought?
Ah, old and worn and tired, we find
Life's more amusing than we thought!

The last line sums up in a playful fashion the common-sense philosophy of ten thousand ordinary middle-aged people.

And yet it is of very little use to rail at amusements in the midst of an age which is probably more amused than any other since the beginning of all things. Every day sees more and more places of amusement of every sort opened throughout town and country. The number of theatres built during the last ten years is something prodigious. The *fêtes* and galas are forever on the increase. If the old-fashioned fair has been dying out, the modern benefit-club and the new-fashioned festival have taken its place even in the country village. Lawn-tennis has supplanted croquet, and tournaments — with a difference — have once more come into vogue. Our watering-places increase apace;

and so do our winter stations. As to our minor watering-places, their name is Legion. It is an age strenuously bent upon getting amused; and it will certainly get itself amused if money and buildings and appliances will help it at all in that matter. It will have bands and spas and *fêtes* and gardens and plays and races and games and galas to its heart's content. It will have fireworks and monster meetings and centenaries and musical festivals and processions and demonstrations and excursions, and all the rest of it. It will run over all the world in search of amusement, and, when it is tired, it will come back at last to "seas and skies," castles and abbeys, lanes and flowers. But, let middle age preach as it will, youth will have its cakes and ale to the end of the chapter.

XXIII.

THE PRIDE OF IGNORANCE.

WE often hear a great deal about the pride of knowledge or the pride of intellect ; and perhaps knowledge and intellect sometimes are proud, though, to be sure, those who have mixed most with the really greatest and wisest men generally find them marked instead by profound modesty, deep humility, and extreme caution in the expression of opinion. But people do not usually lay enough stress upon that opposite and singularly topsy-turvy form of pride, the pride of ignorance, which nevertheless does really exist and flourish amongst us in a very high degree of development and perfection. Nothing is commoner than to hear the hard-headed practical man plume himself openly upon his own undisguised want of knowledge. "Scientific people will tell you so-and-so," he says, patronizingly, with a little deprecatory wave of his hand, like Mr. Podsnap ; "I dare say they're quite right. They may be ; I know nothing about it. But, for my part, I'm not in the least scientific. I don't pretend to know anything at all upon the subject." And then

he stands with his back to the fire, and assumes a profound air of moral virtue, as though there were really something very fine and noble in his determination to know absolutely nothing about the matter in question. He is every bit as proud of his ignorance as the wisest man is proud of his knowledge. Every bit as proud, do we say? If the truth be told, ten thousand times prouder; for true greatness is always unassuming. It knows enough to know how little it knows; it has learnt the vastness of God's universe and the pettiness and feebleness of the human understanding; and so it is neither proud of its knowledge on the one hand, nor of its necessary limitations and deficiencies on the other.

But why are people proud of their ignorance? What good thing can there possibly be in the want of knowledge that any human being could ever be proud of? At first sight it is hard indeed to see the explanation; but perhaps it lies in two deep-seated and fundamental principles of human nature. In the first place, people are almost always, in their heart of hearts, proud of themselves from top to bottom. They are proud of their very weaknesses and failings. The ugly man is proud that he is not one of those conceited jackanapes that strut about the streets and exhibit their fine teeth whenever they speak, with their inane smile and grinning stupidity. The miser is proud

that he is not a wretched fool of a spendthrift; the spendthrift is proud that he is not a horrid old curmudgeon of a miser. The drunkard prides himself on not being a nasty straight-laced teetotaler; the libertine prides himself on not being one of those ugly, sour-faced oily hypocrites who look as if they had swallowed a poker in their youth and never digested it. So, it is probable, the ignorant man prides himself on not being a dry stick of a pedant — on knowing the world and men and things, not mere dull and empty useless book-knowledge — on rising superior to those poor fools of scientific men who think they are so prodigiously well up in everything because they know a bit of mathematics or a trifle of chemistry. Human vanity is so inexplicably deep that it will find out a virtue in every form of vice and every kind of deficiency, provided only they are its own personal ones. Then, again, in the second place, there is the undoubted fact that practical men and the world at large immensely underrate the real importance of accurate knowledge. They get so many things already done for them, in our extremely complex civilization, by the men who really do know, that they forget how very ill they would actually fare if it were not for the existence of the exact people whom they so often despise and laugh at. “At what o’clock will the moon rise to-night?”

asks the farmer who has to take a long cross-country drive by lonely lanes on a dark evening. "Oh, look in the almanac, and you'll find it in a minute!" "When will the tide be high enough to cross the bar?" asks the sailor off the mouth of a difficult harbor. "Oh, look into the sailing-directions, and you'll see it put down plain and simple in black and white for you!" They forget that the calculations the result of which they can thus so easily secure were made for their use beforehand by long hours of patient work on the part of trained and educated assistants at Trinity House or Washington Observatory. Thus ignorance continues to despise knowledge through mere oblivion of its own indebtedness.

The fact is, every action and every movement of our own lives, in the midst of our high existing civilizations, are dependent in a thousand ways upon remote and difficult scientific calculations, the very nature and special usefulness of which most of us are absolutely incapable of comprehending. No ship, for example, could sail the sea to bring us the tea of China or the wool of Australia, English hardware, or West Indian sugar, were it not for abstruse and complicated mathematical calculations, reckonings of latitude and longitude, of sunrise and sunset, of transits of Venus and lunar eclipses, of right ascension and declination and horizontal parallax and semi-

diameter, and half a dozen other minute measurements, all unknown even by name to sailor and boatswain, but duly entered by anticipation for captain and mate in the *Nautical Almanac* by the continuous labor of a hundred skilful and profound astronomers. The very men who sail the sea in safety by the aid of those prodigious and learned calculations would probably be the first to deride and despise the philosophers upon whose accuracy their lives depend, as poor foolish star-gazers and absurd theorists. "What good does it do us to weigh the moon or to measure the distance from here to the sun?" ask hundreds who do not know that without such knowledge we cannot make our way securely across the Pacific, and that an error in the determination of some small fact about the satellites of Saturn may cost us the lives of many seafaring men and the cargoes of many valuable ships, wrecked through erroneous observations on the reefs and barriers of the New Guinea passage or the Bahama channel. What can be more absurd than experimenting upon sparks from amber or a cat's back? And yet experiments of the sort, so seemingly useless, have given us at last the indispensable electric telegraph, by means of which we can govern the course of the markets in Sydney and Calcutta, in the Cape of Good Hope or the farthest confines of Afghanistan. Who does not

laugh at the "mere theorists" who investigate the causes and nature of disease? Yet the "mere theorists" have already succeeded in all but restraining the ravages of small-pox, and are now engaged in stemming the tide of cholera, with remarkable results, throughout the South of Europe.

One very noteworthy way in which the pride of ignorance is frequently exhibited is the presumptuous readiness with which utterly unlearned people will sometimes demolish at a single blow Newton's theory of gravitation or the Copernican system of the solar family. Nothing is commoner than to find a silly schoolgirl or an ignorant boy demonstrate at once with a few simple arguments the flatness of the earth or the untenability of the Newtonian hypothesis. Such people have no idea of the long, slow, and laborious method by which the results they attack have been originally reached and gradually tested. They do not know that innumerable experiments have been carefully tried, innumerable measurements accurately made, innumerable precautions continually taken against the slightest error or vitiating element. They do not understand that a great philosopher, sitting down to investigate a profound problem, works at it long from every side, eliminates every possible source of mistake, starts every conceivable objection himself, and meets them all by every subtle

and crucial experiment that his skill and his ingenuity can in any way suggest to him. They are not aware that the moment his conclusions are made public they are subjected to a close and eager scrutiny by a hundred other scientific men, sifted, tested, pulled about, dissected, if possible assailed, denied, and refuted. Men of science are always trying one another's supposed discoveries or inventions with the utmost keenness, frankness, and critical acuteness. They are not restrained by considerations of polite reticence; if they believe an experiment to be inconclusive, or an inference to be false, they say so not only plainly, but bluntly and pointedly. They sit as a perpetual court of appeal to hear cases sent up to them for trial from the individual discoverers. Whatever belief escapes their careful and close examination, whatever idea is stamped by their universal and cordial approbation, may safely be accepted by the rest of the world as fairly irrefutable. Men who know anything at all know, for example, that the earth's rotundity has been abundantly proved over and over again by endless experiments and observations, and still more by the successful carrying-out of innumerable schemes or calculations based upon its known size and shape and degree of oblateness. Every ship that makes its way from one port to another by daily taking the lati-

tude and longitude verifies the belief that the earth is round, and a hundred other beliefs as well, as to its relation to the sun, its orbit, its nutation, and so forth, through all the long string of its recognized astronomical and cosmical properties. But absolutely ignorant people are always to be found, in spite of their own crass inacquaintance with the very elements of the abstruse subject, to deny the fact that the earth is round, to dispute the truths about its condition as a planet, and to declare dogmatically their unfounded belief that it occupies the very centre of the universe — a belief wholly incompatible with the due arrival of the tea they drink every morning for breakfast, or the sugar with which they sweeten their whiskey toddy every night at bedtime.

Another very noteworthy form of the pride of ignorance is that which assumes the guise of humility, and declaims against the supposed intellectual arrogance and blindness of others. This particular variety of the affection habitually takes a mock-modest shape. You happen to observe of a particular geological specimen, it may be, that it probably dates back (as science has decided) to a couple of million years ago or so. Pride of ignorance is immediately aroused. How can you venture to make such a terrible assertion? It is contrary to your critic's own personal interpreta-

tion of the letter of Scripture, and he is astonished that you should have the boldness, the audacity, the unparalleled arrogance to set yourself up against the precise words of inspiration. You venture to reply with all humility that, in the opinion of many among the most eminent Hebrew scholars and Biblical students, the words in question do not necessarily bear the meaning he chooses to assign to them, while the positive evidence of geology on the point of antiquity is clear, certain, and incontrovertible. Pride of ignorance can hardly contain its indignation. Your interlocutor assures you, with an air of immense superiority, that for his part he does not pretend to understand Greek and Hebrew, and that he thanks Heaven he knows nothing at all about geology; but he can see the plain meaning of Scripture as well as any man, and he is astonished that you, who set yourself up to be some great one, should dare to differ from inspiration upon the subject. You reply humbly that in these, as in other matters, opinions vary; that you differ not from inspiration, but from him; that, after all, his interpretation is only his interpretation; that a complete ignorance of Greek and Hebrew is not indeed a special qualification for deciding the question at issue; and that some little knowledge of geology may not, perhaps, be wholly useless in arriving at a conclusion upon an essentially geological

problem. By this time your critic probably loses his temper, and begins to call you hard names, reflecting upon the conduct of your father and grandfather, and hinting in an aside that your second cousin was duly transported some fifty years since to Botany Bay for a bank-robbery. To people of this class, in fact, their own ignorance is a simple source of admiration and self-congratulation. It positively gives them in their own eyes a sort of mental and spiritual superiority over the knowledge of others. They think they are submitting their own opinions entirely to the guidance of an infallible Mentor, whereas they are in reality only setting up their personal interpretations and views on religious questions as a supreme law over everybody else's life and conduct. It is not the letter of Scripture alone that is inspired to them, but their special reading and interpretation of it. Anything that seems to them to conflict with that beloved idol of their own explanation rouses at once their prejudice of ignorance. "Here is this fellow," they say, "who actually ventures to believe himself wiser than my particular private theological opinion. How arrogant of him — how presumptuous! He deserves to be scouted as a rank unbeliever." We get the extreme case of this curious sort of narrow dogmatism in the old story of the illiterate street-preacher who commented in a mistaken way upon

some side-meaning of an English word in the Authorized Version of the Epistle to the Romans. He was told by a better-educated bystander that the Greek could not possibly bear the meaning he assigned to it. "Greek!" quoth the expounder, opening his eyes. "What do I care about the Greek indeed? D'ye think Paul knew Greek?" In his simple soul he imagined that the learned scholar of Tarsus, to whom the language of Greece was in all probability a mother-tongue, had delivered himself to the Church at Rome in the precise phraseology of King James' bishops.

Pride of ignorance, when it takes this last offensive form, is in all probability hopelessly incurable. The man who can fortify his own errors or mistakes by propping them up on the authority of a Divine message is rarely to be dislodged from the strange position he arrogates to himself in his ignorant complacency. And yet it is curious that at some time or other hardly a single great accepted truth has not so been opposed by dogmatic ignorance, hardly a single superstitious belief has not so been bolstered up by Scriptural warrant, hardly a single gross injustice has not so been justified by the misapplied text of some prophet or apostle. The earth's revolution on its own axes was denied, for example, against Galileo and Copernicus, by the whole weight of the Church of Rome. The law of gravitation was objected to

on the ground that it seemed to substitute a secondary cause for the immediate act and will of the Creator. Later still, first geology and then evolution have been similarly decried as opposed to the plain doctrines of the Holy Scriptures. The good and learned Sir Matthew Hale firmly held that, if you did not burn unhappy old women at the stake as witches — for no other crime than because they were bent double and very ugly — you were disregarding the plain injunctions of the divinely inspired author. In our own day we have been similarly told that to doubt the reality of the shadowy white ghost which appeared one dark Saturday night to William Snooks in the haunted house at Little Pedlington is to undermine the very foundations of Christianity. Thousands of excellent people were certain a generation ago that to grant civil rights to the Jews was to cast a terrible slight upon the national religion. A few centuries earlier, in the reign of King John, it was no doubt regarded as a pious work to extract the teeth of Hebrews by slow degrees; and a man who should have objected to the popular method of converting them in the mass by burning down their houses and ill-treating their wives and daughters would probably have brought down upon himself universal condemnation as a very lukewarm, half-hearted Christian. These curious aberrations of the human intellect and these

strange freaks of personal interpretation ought to make us all very careful how we prop up our own ignorant opinions or prejudices by the weight of an infallible Divine authority as expounded by our own very fallible fancy.

XXIV.

INHABITED WORLDS.

· EVER since astronomy first definitely settled the question that our own planet was but one among many, a single small and unimportant member of a large family, all revolving alike around a third-rate sun, in a minor corner of this illimitable universe, the human mind has naturally exercised itself more or less foolishly and persistently over the abstruse question whether any of the other stars or planets were inhabited like our own by rational beings. It seems to us, poor little mundane mortals, in our feeble fashion, that a world or a star not peopled with creatures formed essentially after our own pattern must be in so far waste and useless. The sole object of a planet or other orb, we imagine, must be either to contain and support human beings, like our own earth, or else at least to warm them, light them, and supply them daily with fresh stores of radiant energy, as is the case with the sun, the centre and ruler of our petty system. This narrow mode of envisaging the universe to ourselves is almost inevitable from the very constitution and circum-

stances of human nature. Our race first found itself born and bred upon an apparently flat and limitless world, with sun, moon, and stars dancing attendance over it to illumine it, or heat it, and occupying, so far as natural vision could tell us, the very centre of the entire universe. And, when slowly we began as a race to discover that the world was spherical instead of flat, that it went round the sun, instead of having the sun to run round it daily, that it was one of the least among the members of the solar system, instead of the greatest of all things, and that the solar system itself was but a tiny speck in a vastly wider galaxy of suns and star-clouds — when we began to discover all these disconcerting and unpleasant facts, bringing home to us forcibly our own smallness, feebleness, and slight importance, it was no wonder that we should take refuge in speculations as to the possibility of human life extending into other planets and other systems. We salved our disgust at our own humiliation by projecting ourselves, as it were, into the rest of the universe.

Gradually, as the now accepted nebular theory of the origin of our sun and planets gained ground, astronomers recognized more and more fully the improbability of life extending to other orbs. According to that theory, the material which at present composes the sun, the earth, the

moon, and the planets once existed as a sort of cloud or haze, spread over an enormously wide area — as far, in fact, as the orbit of Neptune, the most distant of the known bodies belonging to our system. Slowly the gravitative force of the entire mass drew it together toward its common centre, at the spot now occupied by our great luminary, the sun. As the cloud condensed and gathered in its hem, it cast off rings, one after another, which formed the materials in the fulness of time for the various planets. Each such planet began its existence as a little sun, a minor mass of red-hot matter, which gradually cooled by radiation on its outer surface, though still remaining at a very high temperature in its inner core. Observation, in fact, leads us to believe that Jupiter and Saturn, the two great giant planets, immensely bigger than our own earth, are still in a state of fiery commotion, subject to terrific throes and cyclones, and enjoying even now their hot and boisterous planetary youth. Indeed, since large masses would take much longer to cool down than small ones, this is just what we should reasonably expect to be the case; the big planets ought naturally to retain their heat longest, while the smaller ones ought of course to present every appearance of a chilly exterior in exact proportion to their minuteness of size. The moon, our own insignificant satellite, shows us in fact the very opposite

extreme in this respect to Jupiter and Saturn ; it is evidently a cold and burnt-out little world, devoid of all its original fiery energy. It has no water anywhere upon its surface ; no atmosphere clothes it with a gaseous covering ; it exhibits one terrible and deathlike scene of bare rocky volcanoes and yawning craters, undiversified by the foliage of trees or the green carpet of grasses, and barren of any passing sign of animal and vegetable life in any part of its desert expanses.

Now, it is quite clear that, in either of these two extremes of planetary existence — in the fiery youth of a world, or in its cold old age — the occurrence of life upon its surface, at least in any form that we can at all realize, is absolutely inconceivable. While a young earth is still in a molten or semi-molten condition, like glass in a furnace, plants or animals as we know them here could not possibly exist upon its incandescent lava-fields. On the other hand, when it has grown old, chilly, waterless, and airless, when all its oceans have been sucked up by its rocks, and all its atmosphere slowly absorbed into its crust by chemical action, the existence of any living thing upon its bare and wrinkled face becomes of course utterly impossible. Hence, even if we suppose that every planet is at some time or other necessarily and naturally fitted for supporting life, it can do so only during its middle period, such a

middle period as that to which the whole geological history of our own earth bears witness, from the dawn of life to the present day. It would be rash to assert that during such an intermediate age every planet does actually prove the theatre of life of some sort; all that we are entitled legitimately to assert is merely this, that under such and such conditions, and under no others, life becomes at any rate possible.

This consideration shows us at once how foolish are the ordinary hasty speculations of thoughtless reasoners as to the possibility or probability of "other worlds than ours" being really inhabited. When such people say "inhabited," they mean in effect, though they do not say so, inhabited by human beings like ourselves, or at least by other and similar rational creatures. But the real point to be settled first is a far more fundamental one; it is the prior question whether life in any form, animal or vegetable, or anything resembling it, is there possible. For man presupposes beef and mutton, wheat and potatoes, or something at any rate very like them. How narrow and illogical it is to concentrate our attention solely on the probability or improbability of there being men and women in Mercury or Venus, while we never think of inquiring whether there are lions or tigers there, oak-trees or chestnuts! And that, again, leads up naturally to the further conclusion

that in no case is it probable any particular plant or animal would reappear identically in any two distinct planets. For consider how immensely, even in our own world, the plants and animals differ in different countries. In Europe we have all elms and ashes, dogs and horses, weasels and foxes, sparrows and jackdaws. In Asia, on the other hand, they have palms and baobabs, elephants and camels, jackals and rhinoceroses, parrots and sunbirds. Still more strikingly different are the products of the sea from those of the land — the wrack and the sea-weed, the fish and the lobsters, the whales and the seals — from the plants and animals of the dry earth. And, if within the limits of our own planet we find such an extraordinary diversity and wealth of variety, how can we expect with any show of reason that in the widely unlike circumstances of a totally different world any single form such as we here know it would be separately produced in exact fac-simile?

“Surely,” it may be objected, “even if there be no men in the other planets during their period of life, if such they have, there must at least be rational creatures! It is hardly to be supposed that whole worlds would be wasted, as it were, upon lower forms of life alone, and that planets immensely vaster than our own would be thrown away upon mere unreasoning creatures.” Perhaps not — we cannot say; thus much alone we know

for certain. Our own earth existed for countless millions of ages before man at last appeared upon its surface. Period after period rolled slowly on, from the remote past of the lifeless epoch, through the days when first the fishes, then the reptiles, then the birds, and then the quadrupeds appeared upon the scene, before a human form or a human mind ever graced the wilds of our planet. Yet nobody looks upon those long eras of geological time as in any sense wasted, merely because man was not yet evolved or created. Why, then, should we think it absurd that other worlds might go forever without rational inhabitants? Not, of course, that we would dogmatically deny the existence of such inhabitants at some time or other in the various planets. On the contrary, it seems to us more reasonable to believe by analogy that life of some sort or another will always be developed on the surface of every world where the conditions are fitted for it, and that the larger the world and the longer the duration of its life-bearing stage, the higher will be the types of life produced upon it. If we were to trust to analogical reasoning at all in so uncertain a matter, we should say it is most probable that rational creatures will ultimately inhabit Jupiter and Saturn, of far greater perfection and nobility and virtue than any of ourselves in this tiny spheroid. But to say that they would resemble man in any way

would be very unreasonable, considering how immense is the diversity of appearance, habit, function, and nature among the animals alone of our own planet.

Yet even to assert that the other planets would be wasted in the scheme of the universe because they do not or may not contain life is in itself a gross piece of purely human and mundane arrogance. It is as though an ant, emerging from its nest and surveying the ocean, were to declare that all the vast expanse of waters was wasted because it did not afford room for innumerable ant-hills. What, after all, is life or humanity that we should erect it into a measure and standard for the great wide universe? We do not consider the earth's interior wasted because no life is possible there. We are not even greatly affected by the sands of Sahara and the Himalayan snow-fields, the north pole or the antarctic continent. We do not complain that the sun is too hot to hold living creatures, and that the fixed stars are in a continual state of fiery agitation. It is only the barrenness of planetary surfaces that thus affects us, because we think that there at least some form of life is fairly conceivable. But why should we demand that the universe should be laid out for life at all? Why believe that life is necessary anywhere in any way outside the limits of our own little planet? It may well be that plants and animals

are wholly peculiar to this petty world of ours. It may well be that the special conjunction of minute circumstances which renders the existence of life possible may never have occurred, and may never again occur, upon any one of the countless orbs that speck the vast expanse of the heavens. Or, again, it may well be that life is an almost inevitable incident in the existence of a planet; that every cooling and condensing world, supplied with light and heat from some neighboring sun, becomes naturally the scene of living energies on the part of creatures resembling plants and animals as we know them. But, in either case, there is surely no necessity to look upon life, human or other, as the end and aim of the entire universe. To do so is to fall into a narrow and restricted human fallacy. We know that all the innumerable fixed stars which stud the evening sky are not and cannot be the abode of living creatures. We know that our own sun, a molten mass so infinitely bigger than this petty earth, is not and cannot be a dwelling-place for plant or animal. We know that, from one cause or another, our satellite, the moon, and most of our sister planets are quite incapable of supporting life upon their fiery or frozen surfaces. We know that for ages and ages our own earth was equally unable to meet the conditions of animal existence, and that, even after she had attained to the evolution of life,

myriads of years were still destined to pass before the first appearance of man upon her great continents. We know, in short, that the vastest expanses of space and time are ordered by Supreme Wisdom without any apparent reference to the existence of sentient or rational creatures. Enormous orbs revolve for immense periods through inconceivable abysses of empty æther, devoid of life or feeling in any form upon their wide surfaces. Evidently, though life is everything to us, mere specks upon the outer crust of a minor planet of a petty sun, it is not everything in the vast Divine scheme of the material universe. We suppose it to be so only because of our narrow human intelligence, forgetting that the heavens may declare the glory of God just as much in barrenness and vastness as in populousness with tiny creatures like ourselves—that the universe as a whole is not necessarily constructed in accordance with our finite human conceptions of fitness and usefulness. To us nothing is good which does not subserve human happiness and human comfort. But is it needs so with the entire *cosmos*? Are we tiny ants in our human ant-hills to be regarded as the sole measures, moral and physical, of the great and marvellous galaxy around us? The idea is simply ridiculous. Our doubt whether life does or does not exist upon other worlds affects in no way the grandeur and

beauty and glory and perfection of the existing universe. The sea is none the less great and sublime because we cannot till it and build brick cottages upon it. Let us recollect that even this earth is mostly water, and restrain our foolish human desire to find a sort of human fitness and utilitarian propriety in every detail of the vast creation.

XXV.

BRICK AND STONE.

It is a curious reflection that the rise and progress of the arts in general, and of architecture in particular, in every country, have been largely dependent upon the nature and peculiarities of the various materials which each nation found ready to its hand in the immediate neighborhood of its own great towns and cities. Thus, for example, Egyptian architecture was immensely influenced by the granite of Syene, the solid grain of which naturally contributed the massive columns that we all associate with the colossal temples of Thebes and Karnak. So, too, Egyptian sculpture, for the same reason, being mostly hewn from that very rigid and intractable material, displays everywhere a stiffness and a want of plasticity nowhere else to be found in the entire statuary of any other civilized people. Clearly, it would have been impossible to carve from solid syenite the outstretched arm of the Apollo Belvedere or the graceful limbs of the Medici Venus. Hence most Egyptian sculpture is constantly marked by symmetrical regularity of the two halves of the body ;

the arms lie flat and outstretched against the sides, and the legs are pressed close together in the stiffest possible and most formal manner. The rapid development of Greek art, on the other hand, with its singular outburst of grace and freedom, must be largely connected with the pure white Parian marble quarries of the Greek archipelago, from which are carved both the columns of the Parthenon and the exquisite forms of Hellenic statuary. Assyrian sculpture and architecture, founded mainly on alabaster and plastic clay, stand midway, accordingly, between these two extremes, leading on from the heavy and ungainly Egyptian stiffness to the free and natural Athenian grace. So we find in every country that the material upon which the native artist or artisan is necessarily compelled to work in early ages has done much to give color and tone to the whole future course of national development in many directions.

Take, for another excellent example of the same truth, the common industrial art of China and Japan, as compared with that of Greece and Italy. Look at the mere influence on Chinese art of the habit of tea-drinking! It has given the entire fictile handicraft of the country a twist towards the production of tea-pots and tea-cups; and it has caused the whole process of tea-growing and tea-drying to be represented over and over again

in a thousand different blue-and-white designs, familiar to all of us on plates and vases. In Greece it was the grape that held the same place. Wine was there the drink of the country, the sacred drink of the gods; it is the child Bacchus playing with a bunch of the purple fruit that we get, instead of the fat complacent mandarin calmly sipping his fragrant bohea at the little wicker table in the back garden. The vine-leaf and the thyrsus, the vase and the beaker, the great two-handled wine-jar and the earthen amphora — these are to Greek and Roman habits what the tea-plant and the tea-caddy, the delicate porcelain cup and the dainty tea-pot, are to Chinese and Japanese culture. And here again the possession of kaolin, or China clay, from which the porcelain itself can be manufactured, strikes the key-note of the Chinese fictile art, just as the common red earthenware of Greece and Italy lends itself naturally to the red and black Athenian and Etruscan decoration, so familiar to all of us on ancient vases or modern Wedgwood imitations. Look, once more, at the influence of paper on Japanese art. How much the lanterns and the parasols, the fans and the pictures, the hanging scrolls and the thousand and one little decorative knick-knacks that now adorn half the shops and houses in London and New York owe to that cheap and common material in the hands of the skilful Japanese workman!

Without paper and its handmaid the bamboo-cane, where would be the innumerable pretty little colored nothings that at small cost now make bright innumerable homes with the quaint exotic decoration of the Far East?

But if the material which comes naturally to the hands of the artisan has often had so great an influence for good on the development of handicraft, it cannot be denied that it is frequently answerable for much that is painfully ugly and in every way to be deplored. London itself, above all other English towns, affords us a most unfortunate example of the bad results that necessarily flow from a great city being confined to a cheap and bad form of raw material. English architecture has suffered terribly from the fact that London stands in the very centre of a great stoneless valley, surrounded by numerous patches of inferior brick-earth. There is no good sound building-stone to be had anywhere within easy reach of London or the lower Thames. The great city is built for the most part on stiff London clay or on loose glacial gravel, with here and there a single suburb stretching away upward on to the soft and friable Bagshot sands. The consequence is that from the very first the only building-material that could possibly be used for the common class of London dwelling-houses was the very unsatisfactory local brick-earth. True, in the Middle Ages

Caen stone was imported from Normandy for the production of the handsomer and more important ecclesiastical edifices, and in later days the Bath stone and the Portland stone have been freely employed by architects for private mansions, or for the great clubs whose handsome row of palaces now lines the long and imposing front of Pall Mall. London Bridge is constructed of Dartmoor granite from the slopes of Hey Tor; and several important city buildings have been erected from the famous cold blue stone of the Aberdeen quarries. But such expensive and far-fetched materials could never of course be commonly employed in ordinary domestic street-architecture; and even at the West End London houses have usually been constructed of brick only, and that often of inferior quality. The use of this sadly inadequate material in the appropriate hands of the jerry-builder has largely contributed to depress and stunt the development of English architecture, and especially to give it a wrong direction.

That wrong direction may be particularly noticed in the unfortunate invention of stucco, which is, in fact, a sham device for making a brick building pretend externally to be a stone one, or at least look as much like stone as it possibly can. For some generations the one desire of the British builder seems to have been to disregard the natural capabilities of brick, the material to which he was

necessarily restricted, and, instead of working out a pretty and consistent brick style, to imitate the characteristic effects of stone as well as he could by copious layers and entablatures of stucco. Fortunately of late years a great change has come over the spirit of English domestic architecture in this respect, and nowadays a new and pretty mode of street house-building, which it is fashionable to call by the somewhat absurd title of the "Queen Anne style," has been introduced—a mode basing itself entirely upon our good native red brick, and insisting upon employing this sound, solid, and sensible material in an open, honest, and straightforward fashion. It makes no pretence of imitating stone, but tries to produce in red brick the best effect of which red brick is capable. Even here, however, there is some danger of a curious freak of fashion spoiling the result of a really good and solid improvement; for, in many districts where excellent building-stone can be readily obtained, people will now build red-brick Queen Anne houses "because they are so fashionable"; while we have even seen in certain towns a large house with all its back and side walls solidly constructed with local limestone, but its street-front faced with modish ruddy brick, in order to keep itself entirely in the running with London houses. This is a very foolish artistic mistake. No good architect and no sensi-

ble practical man would ever employ brick for the ornamental parts of a building in a country where stone was cheap and abundant. It is only because London lies in the very midst of a stoneless, rockless, brick-yielding valley that London architects have been compelled to develop a school of architecture which takes brick for the very basis and fundamental groundwork of its entire evolution.

If we look away to other places, in America or abroad, we shall see at once how vastly superior is the general effect of street-architecture in those towns which possess at their own doors a good, solid, and durable building-material. Fifth Avenue, in New York, and Beacon Street, in Boston, owe much to the beautiful brown freestone of New Haven. Bath, again, comparatively small though it be, is a far handsomer and nobler-looking town than Brighton, because Bath is built of its own splendid and imposing local stone, which gives to the Circus and the Crescent, to Milsom Street and Laura Place, an air of dignity and architectural plan wanting in almost every other English city; whereas Brighton, standing on the flanks of a bare chalk down, has had to trust for its long and gay sea-front to brick and stucco, while its old and quaint little parish church is constructed of no better or handsomer material than the split flints collected from the lime-pits on the downs behind it. What a contrast to the noble and beautiful

outlines of Bath Abbey! So, once more, Edinburgh, situated in the midst of a magnificent stone-district and surrounded by numberless excellent quarries, is one of the handsomest and best-built towns in all Europe, the front of Princes Street, in particular, being a sight that no one who has once beheld it can ever forget throughout a whole lifetime. The lack of solid building-materials among the soft crumbling red sandstones of Cheshire led to the survival in Chester of the quaint old-fashioned English pargeted houses, with their prettily intermixed fronts of plaster and woodwork; while many mansions, and not a few churches, constructed in the same curious and effective style of domestic architecture, are scattered up and down over the face of the county. In Aberdeen, on the other hand, the local granite lends its cold gray grandeur to the solemn and imposing sweep of Union Street, a worthy thoroughfare for the great bleak northern city on the German Ocean, with its antique colleges and its gay shop-fronts, its fisher-village, and its bustling busy modern quays. Everywhere we can see that the local conditions have largely modified the local architecture, and that where a good and plentiful native building-material existed from the beginning ready to the workman's hand, a commensurate effect has been easily produced with but little expenditure of conscious effort.

Paris forms another excellent example of the influence of material upon street-architecture. It stands upon endless quarries of a soft and very workable freestone which lends itself readily to the chisel of the architectural sculptor and permits of infinite indulgence in scrolls, figures, and ornamental handicraft strictly in accordance with the florid and gaudy Parisian taste. The old Paris made comparatively little use of this its natural mineral wealth ; but the new city which grew up under the fostering hands of Baron Hausmann has utilized its splendid stone-quarries to the utmost, if not with any great picturesque effect, at least with much stateliness, uniformity, and dignity of plan, only here and there degenerating characteristically into vulgar meretricious ornament. The great boulevards which stretch out radially from the centres formed every now and again by round points adorned with fountains run very straight *ad infinitum*, and are composed of exceedingly tall and rather monotonous white stone-fronted shops and mansions ; but, as a whole, they possess a certain grand imperial dignity of their own, and, when lighted up at night with the electric light, are worthy highways for the gay metropolis of a great civilized and enlightened people. No sight on earth is more impressive in its way than a glance from one of these central diverging points down avenue after avenue of stately, noble, and

imposing buildings. That is the result of Imperial despotism and an organized plan, ruthlessly carried out at the expense of all possible discomfort and inconvenience to individual persons. In New York, with its tall, irregular, uneven shops and its magnificent brown-stone private houses, one sees, on the contrary, the opposite result of Republican freedom and individuality. The brown stone of which most of the houses in Fifth Avenue are built forms one of the richest and handsomest building-materials to be found anywhere among the cities of Christendom. Each house stands a little apart from its neighbors; each has its own personality and characteristics; and the abundant growth of Virginian creeper which drapes most of the rich ruddy fronts under the blue and cloudless sky of America gives an air of rusticity and elegance to the whole which could hardly be imitated in any crowded European capital. It will be long before London has any street of such perfectly natural well adapted houses; but the pretty rows which are now filling up Hampstead and many other favorite suburbs may encourage one to hope that in the course of time even the gloomy English streets may acquire a little more brightness, variety, and interest than has ever hitherto characterized the productions of British architecture.

XXVI.

EVENING FLOWERS.

It is one of the strong points of the new school of naturalists which has grown up around us during the last ten or fifteen years that they are no longer content, like their predecessors, with merely stating how such and such an animal or plant is fashioned here or there in such and such a particular manner, but that they always ask themselves the further and far more important question, Why is it fashioned just so, and not otherwise? Every band or belt of color on a butterfly's wing, every fold or lobe of foliage in tree, or shrub, or weed, or creeper, every crest or knot of plumage on parrot or humming-bird, must surely have its due and sufficient purpose in the great balanced economy of Nature. As the German observer Sprengel justly put it, when he was led to his marvellous investigations into the hues and shapes of flowers by the simple observation of a few small hairs on the petals of a wild geranium, "The wise Author of Nature would certainly not have created even a hair in vain." Working down from this luminous original thought, Sprengel gradually went

on to recognize the fact that every detail of every blossom has indeed its appointed function in the history of the plant, and that a little careful study will enable the acute human observer to unravel the secret of floral construction sufficiently, at least, to understand the main purport of the principal parts. Every flower differs in a thousand small points of shape and detail from every other, and for each such difference there must needs be a good reason. Of course, all of us recognize in a general way that there are infinite meaning and purpose and design in every portion of external nature; but then we usually recognize it in a very vague fashion only—we never strive to realize it piecemeal throughout all creation in its true complexity. And what we are oftenest thinking of, even when we do bend our minds for a minute or two at stray times to the beautiful adaptations of external nature, is chiefly their relations to the wants of man; whereas, in the world at large, by far the greatest number of adaptations are those which relate to the needs and peculiarities of the plant or animal itself. Each organism and each species is a wonderful piece of complex mechanism, so arranged as to fit harmoniously into some particular niche in nature, and with every part exactly ordained for the special function it is intended to perform. Quite apart from their secondary uses in minister-

ing to man's artificial or natural needs, every portion of every creature has its primary use in ministering to the welfare of the organism of which it forms a part.

Most of us, for example, have probably noticed that a great many white flowers, such as jasmine, stephanotis, tuberose, night-flowering cereus, and jonquil, have a very peculiar strong perfume—a perfume which is pleasant enough in small quantities, but which becomes overpoweringly heavy and induces faintness or headache in large masses. Now, this peculiar combination of very sweet scent with white flowers is no mere accidental coincidence, but has a meaning and a reason of its own in the history of the beautiful plants which commonly display it. If one examines a large number of such plants one after another, one is soon struck by the curious fact that they are almost without exception night-blossomers. Most of them open in the evening only, and either close entirely or fold back their petals during the daytime. Moreover, their scent is given forth at night alone, and it then seems to hang heavily upon the surrounding air like a perfumed mist for several yards around, as everybody must have noticed in the case of jasmine climbing around the thick wooden door-posts of some picturesque, old-fashioned cottage. The explanation of this strange coincidence is simple enough—

the flowers in question are specially designed to attract night-flying moths. Their honey is usually concealed at the bottom of very deep straight tubes, which only such moths can probe by unrolling their long spiral proboscis; and the heavy perfume is one particularly attractive to these æsthetic insects, which are thus enabled to discover the hidden store of sweet nectar during the dusk of evening. In the hours of sunshine, when the proper moths are not flying about, the plant economizes its stock of scent by keeping the glands which produce it tightly shut; but, as soon as twilight brings out its appointed visitors, it opens them apace, and so advertises the neighborhood of the attractive honey to its insect friends.

For the self-same reason all or almost all the night-flowering plants have snow-white blossoms. In the gray dusk, blue and red and purple and orange, which prove so attractive to the eyes of bees during the glaring daytime, fade away alike into dull inconspicuousness; but pure white reflects whatever little light may still remain, and so assists the perfume by catching the eyes of the moths and leading them straight towards their evening meal of scented honey. Nocturnal insects, like nocturnal birds and bats, have organs of vision specially adapted to the slender light of evening, and so they can soon detect the small white patches which mark out the flowers among

the darker foliage. Accordingly, we often find two closely allied blossoms differing hardly at all in form or structure, but visited respectively by bees or butterflies on the one hand and night-flying moths on the other, and with their colors strictly adapted to the varying tastes and habits of their winged associates. For example, the common red campion or day-lychnis yields its honey for diurnal butterflies and bees; it is therefore colored bright pink, is scentless, and opens, as its name imports, in the daytime, shutting up again more or less completely as night approaches. The equally common white campion or night-lychnis, on the contrary, yields its honey for nocturnal moths; it is, therefore, pure white in hue, it distils a sweet scent towards nightfall, and it opens in the evening, fading or closing during the heat of the day. Sometimes, as in the case of the evening primrose, night-flowering blossoms are very pale yellow instead of white; but pale yellow is equally well seen in the dusk, having, indeed, a peculiar half-phosphorescent appearance in the early evening, which renders it particularly useful for attracting moths. In no case, however, are night-flowering plants provided with spots, lines, patches of color, or variegations upon the face of the petals. These curious marks are confined to day-flowering blossoms, where they serve as honey-guides to point out the position of the nectaries,

and lead the inquiring bee with a minimum of trouble to his store of honey. They would, of course, be invisible at night; and so they are never found on the white or pale yellow nocturnal flowers, which are invariably uniform in color throughout.

All these minute provisions and adaptations are naturally very convenient for the bee and the moth; but how, on the other hand, do they benefit the flower? We said above that every part of every organism has a purpose to subserve which is immediately useful to the organism to which it belongs; and here we seem rather to be pointing out that the flowers are constituted in such and such ways, not for the good of the plant, but for the good of the bee or the butterfly. Nevertheless, there is an easy way out of this apparent paradox. The arrangement is a mutual one; the insect does as much for the blossom, in the long run, as the blossom does for the insect. All that the moth wants, of course, is the honey; but, in securing for himself that sweet nutriment, he performs unconsciously a service for the plant of the first importance. Suppose we follow him on his rounds among the common white campions, on a summer evening, and see what advantage the flowers derive from encouraging his airy visits. Attracted by the faint perfume and pale white petals, he settles down, after a minute, on a cam-

pion-blossom with ten little mealy pollen-bags hanging out temptingly at the end of their long stalks or filaments. As he thrusts his proboscis deep into the recesses of the fragrant flower in search of the honey, he dusts over the top part about his mouth with the floury pollen-grains which form that sticky yellow powder that every one must have noticed in the centre of most garden-blossoms. As long as he goes on visiting similar white campions provided with the same sort of pollen-bags, he only continues to collect more of the soft yellow powder upon the base of his proboscis. But by and by he happens to arrive at a rather different flower of the same kind, which is alike in every other respect to those he has already visited, but possesses in its middle an unripe seed-capsule, instead of pollen-bags, filled within by tiny formless embryo seeds. These embryos require the fertilizing influence of the pollen in order to make them grow out into perfect seeds; and the moth, in passing from one plant to another in search of honey, unwittingly conveys the precious powder from the first kind of blossom to the budding seedlets of the other. Thus, while the plant provides honey for the sustenance of the moth, the moth on his part—to adopt a transparent metaphor—repays the plant by acting as a common carrier of pollen from one flower to its nearest neighbors.

The great object of nature in all these curiously minute arrangements is to secure the production of healthy seed, and so to carry on the life of the various species of plant from one generation to another. In many kinds of plants the pollen and the seed-capsules are borne side by side in the same flowers; but even then care is particularly taken that they do not both mature simultaneously, or else some other device is introduced by means of which the chief end of nature — cross-fertilization of the seeds in one blossom by the pollen from another — is duly secured. In these common white champions the means adopted is a simpler one; the pollen-bags are placed in separate flowers from the seeds, so that it is absolutely impossible for the capsule to get accidentally dusted over by the falling grains, as sometimes occurs in other cases. Indeed, a few kinds of plant almost invariably thus fertilize their own seeds; but then they are, with very few exceptions, the weediest and most degenerate of all flowers. All the beautiful and conspicuous ornaments of our gardens are deliberately designed to encourage the visits of bees or butterflies, unless they be of tropical origin, in which case they are sometimes specially intended to attract the eyes of humming-birds and honey-sucking paroquets. Such southern birds, with their long bills and flickering tongues, are quite as well adapted as moths or bees to

carry the pollen from one blossom to another, and so in the end to secure the continuance of their own food-plants to future summers. Tropical flowers of this class have usually very deep funnel-shaped bells, and many of them may be seen as familiar decorations of our greenhouses and conservatories. Blossoms with such long tubes would be useless and impossible in a wild state in northern climates; we have no birds fitted to visit them, and no insects with a proboscis long enough to reach their store of honey, so that in our own woodlands they would necessarily die out at the end of a single life, for want of means to set their seeds, and so continue their existence in the persons of their seedling descendants.

The whole world of nature is everywhere full of these marvellous inter-relations, which modern science is only just beginning to unravel in all their complexity. As we see at once from this single example, the merest spots and lines and hues and scents of flowers are never without their sufficient purpose; and if we cannot, at a first glance, find out their meanings, we can almost always begin to spell them out, at least, by dint of longer and more patient study. The hairs on the moth's proboscis are themselves there with the deliberate object of collecting the fertilizing powder from the flowers it visits; and, if they were not there, the plants upon which the moth

feeds must very soon die out altogether ; for they are dependent for their fertilization upon the kind offices of their insect visitors, who could not convey the pollen from one plant to another without the intervention of these inconspicuous but useful little hairs. It is indeed a narrow view of nature which regards it all as too exclusively designed with a sole eye to the comforts and necessities of the human race. Man, of course, forms the head and crown of the whole visible creation ; but he is, after all, only as it were the last and greatest wheel in one vast and harmonious universal mechanism, every other wheel in which has equally its appointed part to play in the system of the cosmos. Each of these minor wheels, however inconspicuous to us, has its own cogs and fittings, which enable it to work smoothly with all the rest. The plant has its leaves and stem and roots for its own purposes ; it has its bright flower primarily to attract the insect visitors, and only secondarily to gratify the human vision ; it has its fruit and seed originally for the continuance of its own kind to future generations, and incidentally only for our use and sustenance. In its own way it is as well worthy of minute study as the human body itself ; and, when minutely studied, it repays us well by disclosing at every step new and hitherto unsuspected correlations with all the rest of the animal and vegetable

world. From the point of view of the new natural history, every living thing is thus a sort of perpetual puzzle, a practical problem, a series of curious riddles for human ingenuity to unravel if it can; and when we have read the secret of each to the bottom, we discover a fresh charm and a new meaning in every neglected detail of the entire physical universe.

XXVII.

BEAUTY.

BEAUTY, says the old saw, is but skin-deep; yet the proverb itself, as a great philosopher has justly remarked, is, after all, but a skin-deep proverb. To be sure, there is a sense in which beauty lies on the very surface of a human face; take the most lovely woman in America, and let a skin-disease ruin her complexion, and you reduce her at once, if not to ugliness, at least to comparative uncomeliness in the undiscerning eyes of almost half humanity. Yet there is a profounder and truer sense in which beauty is anything but skin-deep; for, though injury to the skin may conceal or alter it, a great deal more than such mere external characteristics is involved in making a man handsome or a woman beautiful. In the very deepest sense of all it would be far more correct to say that beauty depends upon the highest conformity to the ideal of our race, alike in physical, intellectual, and moral qualities. Our love for human beauty is in the last resort a love for all that is healthy, noble, and admirable in the human mind and in the human body. This view,

though not the one most commonly accepted, is a far more inspiring one than the base idea that beauty resides merely in the outer film of humanity, and it is at the same time far truer also.

If one looks the matter for a moment in the face, it is quite clear that the opposite belief cannot seriously be defended on its own merits. Suppose it possible that we were to consider people beautiful without any regard to their healthiness, their intelligence, or their moral qualities; what would be the consequence? Why, we should to a great extent choose one another in marriage and friendship quite independently of these very important considerations, and the result would be that the deformed, the unhealthy, the hopelessly stupid, and the hopelessly cruel or selfish people would run just as good a chance of bringing up families in their own image as the sound, the healthy, the able, and the sweet-tempered. But Nature in that case would surely, though perhaps slowly, weed out all the persons with such unwholesome and undesirable tastes. There are indeed in the world around us many men and women with perverted judgments who do not feel repelled by narrow brains, scowling brows, coarse sensuous mouths, and unhealthy-looking faces. But these people die out from generation to generation as a direct consequence of their own foolishness or evil dis-

positions; their children die young of the hereditary taint, or drink themselves into untimely graves, or fall into crime and pass the greater part of their short lives in prisons or workhouses. On the other hand, those healthy persons with sound natural tastes who prefer fresh cheeks, smiling faces, hearty limbs, and open foreheads to the outward and visible signs of decay and degeneracy themselves live long and happily, on the average of instances, and rear large and vigorous families, who, in turn, inherit the active brains, strong bodies, and good moral impulses of their fathers and mothers. In this way the instinct for beauty implanted by Nature in the hearts of every one of us is really an instinct impelling us immediately towards all that is best and soundest in humanity, and causing us to feel an instantaneous repugnance towards all that is unwholesome, uncanny, or undesirable. It is Nature's automatic advice to young people about to marry, urging them to choose rather the best, the soundest, and the worthiest, than the worst, the weakest, and the basest.

Look first at the merely physical qualities. Is it not immediately clear that on the whole a beautiful person, be it man or woman, means usually a perfectly sound and healthy person? We admire a good figure and stout hearty limbs, while we do not care physically for very puny

undersized persons, or for thin spindle-shanks, or for malformation or deformity of any kind. We prefer the well made calves of a cricketer to bandy or bow legs, and we praise a full, round, well proportioned arm, rather than a skinny angular elbow. Excess or defect in any part displeases us. What we like to see is the most perfect adjustment of all the parts to one another. Even very short or very tall people are handsome if they are properly proportioned, but not if they look stunted, or gawky, or overgrown, or have heads too big or too small for their accompanying bodies. Nobody admires a very long nose, nor one too short either; nobody is favorably impressed by a very large mouth, or by immense ears, or by a stumpy neck, or by excessive stoutness. We demand for our standard of beauty the exact mean or perfect central model of the human race. Any very wide divergence from this central and healthy model strikes us as uncomely; if the divergence is in the direction of positive disease or malformation, we usually regard it as distinctly ugly.

So again, to descend to details, we admire a clear complexion and rosy cheeks, which are the proper accompaniment of high health. We dislike pallor, which goes with exhaustion, or overwork, or a feeble heart; and we are less attracted by sallowness, which in most cases indicates a

bad digestion. So decidedly do we associate these signs of health in the skin with all our notions of the highest beauty that pearl-powder and rouge have been invented to simulate the virtue in those who do not naturally possess it, or at least to heighten it in those who do. Pearly-white teeth, once more, are great elements of beauty in such as can boast of them; and the soundness of the teeth has much to do with the digestion, and therefore with all the general health of the whole body. People with bad teeth suffer much directly from the defect, and still more indirectly in the insufficient chewing of all their food. If we take these two small matters alone, it is quite clear at once that the idea of beauty we form about them is far from skin-deep; it is the natural expression of a great underlying physical truth. If people did not care as a rule whether those they were going to choose as partners for life had good complexions or good teeth, the result would be that many more children in the next generation would suffer from indigestion and toothache, and that the race in the long run would thereby be permanently weakened. Of course, when a young man falls in love, he does not consciously think to himself whether his lady-love has a sound digestion and a strong heart; but he is attracted to a certain extent — in most instances — by the outward and visible

signs of these inward virtues, and the original attraction is no small part of the total reasons that influence him in making his choice. Nature has not implanted these instinctive likes and dislikes in our hearts for nothing; they are there, whatever people may say, for good reasons, and they are part of the wise provision whereby, on the whole, the efficiency and soundness of our race are kept up from one generation to another.

It is just the same with the external tokens of strength and vigor in men — the flowing beard, the fine athletic limbs, the agile movements, the frank, hearty, open countenance. What constitutes a handsome man is, as a rule, very much the same assemblage of characteristics as constitutes a good oarsman, a good cricketer, a good soldier, and a good workman. Health has been well defined as the ability to do a good day's work; handsomeness in men might be defined as the external signs of the ability to go on doing a good day's work for the best part of a long lifetime. There are of course cases where beautiful women and handsome men are far from physically strong; but in such cases, if we look a little below the surface, we shall generally find that they are handsome, in spite of some particular source of weakness, because most of their other qualities are sound and wholesome. Thus a woman may be very sweet-looking in spite of bad health,

because we see in her face evident signs of intelligence, of tenderness, of delicate feeling, of fine sympathy; and these positive good qualities may more than outbalance any slight want of physical stamina. But in all such instances it is only that one element of perfect beauty is wanting — in no circumstances could we call anybody handsome in whom there was a positive deficiency even of physical perfection, such as a very frightful face, or a very distorted feature, or a very bloated and unwholesome countenance.

Intellectual qualities are equally necessary in order to make a face truly beautiful in any high or thorough sense. A very low or narrow forehead — not one on which merely the hair grows low, but a naturally contracted brow — is far from our ideal of beauty either in man or woman. A dull and heavy eye is unpleasant to us — a bright, intelligent, speaking eye, on the other hand, immediately attracts us. Much of what we call expression in ordinary language is really the external indication of a quick and vivid native intellect; and, however much we may admire in repose, especially in sculpture, a clear-cut and statuesque face devoid of movement, we never admire it so much in actual life as one of those faces in which the signs of inner thought and passing feeling are always coming and going in ceaseless change upon the ever-varying and re-

sponsive features. Once more, "a rabbit mouth that is ever agape" displeases us; the semi-idiotic look of some dull and foolish people positively outweighs in many cases a considerable amount of regularity and beauty of feature. But an intelligent face which combines the high or broad forehead, the quick or clear eye, the shapely mouth and under jaw, the outward glow of sensible feeling in movements of the muscles—such a face must be at least good-looking, even in spite of some considerable defects of individual portions. Nay, we have even known cases where intellectual handsomeness of this type, in men at least, has actually outlived great and positive bodily disfigurements. One of the handsomest men we have ever seen had had his face cruelly injured in early life by a blow from a cricket-ball; but, though the bridge of the nose was completely broken, and though in repose the face was not a beautiful one, owing to this unfortunate defect, yet, the moment it was lighted up by animation in conversation, the natural brightness of the eyes, the quick readiness of the intelligent smile, the ease with which every feature responded to the brilliancy of the speaker's wit, combined with the charm of graceful and appropriate action, made one forget at once the accidental disfigurement and see only the native handsomeness and power of that originally striking and noble coun-

tenance. A merely nice-looking face of a commonplace sort would have lost all its good looks under such a severe trial — a truly fine and intelligent one merely suffers the loss of its first effect, but still retains all its inherent power to please after the first novelty of the queer external appearance has worn off, and the features, as we rightly say, continue to grow upon us.

Even more important to every right-thinking and sensible person than these outer signs of intellectual vigor is the natural evidence in every face of the underlying moral qualities, for good or for evil. A gently smiling face is pleasing to all of us; a scowling or frowning one is naturally unpleasant. So deeply ingrained in our very natures is this primordial distinction of feeling that even children in arms will smile responsive to their mother's smile, and cry at a frown or a grimace from their nurse or a stranger. Good temper makes even plain or foolish faces often more than merely endurable; a fixed and settled look of discontent, or querulousness, or sulky temperament often spoils the most even and regular features. Some otherwise good faces are rendered unpleasing by surliness, some by pride, some by vanity, some by vacuity, some by malevolence, and some by envy, hatred, malice, and all uncharitableness. Still more immediately painful and distressing to every beholder are the visible

bodily tokens of vice or criminality — the horrid bloated face of the habitual drunkard, the unwholesome pimply countenance of the dissipated young man, the hard, cruel, unlovely features of the most degraded men and women in our worst neglected slums and purlieus. Lowest of all and most hideous of all are the characteristic criminal types — the bullet-headed, bull-necked men with low receding foreheads, horrible flat, broad, coarse noses, large, heavy, projecting under jaws, cruel, crafty, sensuous eyes, and a general slouch of gait and manner which at once bespeaks the slinking attitude of mind and body of the habitual enemy of society. Such men inspire us at once with horror and loathing. To this lowest and most degraded type of all alone do we rightly apply the epithet “hideous.” Hideousness, in fact, implies always something of instinctive moral disgust as well as of mere physical repulsion. If anybody doubts, indeed, whether the sense of beauty is intended by Nature as a guiding light to us in our choice of partners and associates in life, he has only to look at these worst instances, and he will feel at once how instinctively our very eyes and senses warn us against them at first sight. It is of course true, as moralists have long told us, that a pretty face is not everything; but it is also equally true that it is not nothing either. It tells us a great deal that is worth knowing

about its owner; and, as it generally tells the truth, it is one of the means by which, on the average of cases, we are led to make a just selection. If every pretty face is not necessarily good, it is at least true that every good face is in the highest and best sense pretty.

XXVIII.

GENIUS AND TALENT.

ABOUT fifty years ago it used to be the fashion among men of letters to draw invidious distinctions between genius and talent, very much to the disadvantage of the last-named highly respectable and desirable attribute. Now all comparisons, as everybody well knows, are naturally odious; but the comparison between the two particular forms of ability—being usually drawn by the people who considered themselves to possess genius in the strictest sense, while most of their contemporaries possessed only that inferior article, talent—was of course a peculiarly offensive one. The genius, it used to be said, needed no driving of his lofty Pegasus; the steeds that drew his lordly chariot could move as they liked of their own accord, and were sure to lead him in the end, without any guidance on his own part, to some splendid, glorious, or dazzling conclusion. Mere talent must pore over and ponder its humble work; but genius, noble genius, could afford to disregard such human weaknesses as conscientious labor, and to pour its unpremeditated lay

forth at its ease upon the listening ears of an astonished and delighted public. Taking pains, our geniuses told us, was a degradation far beneath their exalted level; they had only to act as the inspiration seized them, and they could turn out magnificent works of art or literature almost unconscious of the slightest effort.

This was the high-flown sentiment of a high-flown age, an age that too often allowed itself to be led astray by its own maxims, and to mistake the rapid outpouring of fluent eccentricity for the true note of divine genius. On the other hand, it has been well said by a far more profound and genuine thinker that genius is nothing more than an infinite capacity for taking trouble. This last description indeed offends at once against many people's conventional notions as to the spontaneity and unconsciousness of genius; but it is, we nevertheless believe, by far the truest, the deepest, and the best one. And it is also a very encouraging and helpful view for every one of us; for it not only breaks down the imaginary barrier between genius and talent, but even that between either genius or talent and mere ordinary hard-working industry. It suggests this great and important truth, that nothing really useful or valuable can ever be done without application, and that, with application, there is hardly anything quite inaccessible to us. The genius, we

venture indeed paradoxically to believe, is nothing more, in the last resort, than a man endowed with an extraordinary capacity for taking pains. Whatever he attempts he endeavors to do, not well enough, not tolerably, not nicely, not perfunctorily, but as perfectly and as admirably as by any possibility his hands or brains can help him to do it. He is simply the very best and most careful workman, the workman who takes the greatest trouble with the particular work — be it what it may — that he is called upon to do.

All this, of course, is extremely opposed to one very common idea of the genius as essentially a man of vagaries and flightiness. The sort of person too often pointed out to one in private life as “quite a genius” is the erratic, clever, lazy do-nothing, who never turns out anything at all in any way, but potters about uselessly all his days on the bare outskirts of his trade or profession. That however is not what we find actually to have been the case with all the great men whom everybody immediately recognizes in life at large as the undoubted geniuses of fact and history. Take, for instance, the art of invention. Does anybody for a moment suppose that the genius of James Watt, for example, struck out all at once the idea of the steam-engine in a single flash of inspiration? By no means. Only long and slow and patient thinking-out of every part and every

detail, accompanied by constant trial of innumerable models and constant alteration of joints or fittings, could ever have finally produced that magnificent practical result of the completed engine. Take, again, the art of discovery. Does anybody for a moment suppose that Newton really worked out his whole splendid theory of gravitation within half an hour of the accidental second when he happened to see that too celebrated apple fall from the apple-tree? So far is this from being truly the case that he actually waited for thirteen years before publishing the first outline of his theory, in order to obtain better information about the moon's weight than any existing at the time when he began his memorable researches. Take, once more, the art of war. Does anybody imagine that Cæsar and Napoleon overran all Europe with their gigantic armies by mere force of innate cleverness, without paying any attention whatsoever to the enormous difficulties of the undertaking? Why, Cæsar himself shows us in his Commentaries that he looked with the interest of a commissariat clerk at the pettiest details of breakfast and dinner for his hungry soldiers; while Napoleon's eye never allowed the smallest matter of discipline or tactics to escape it even in the midst of the severest engagement. It is just the same in everything else. No man, we believe, ever achieves a

great result except by taking commensurate trouble.

But is it so in art and in literature? Surely there, at least, the genius is born with all his gifts already instinctively bound up in him, and he brings them forth in due time, without even an effort, before the eyes of an admiring world! Not a bit of it. The greatest painters have toiled late and early over the profound mysteries of perspective and light and shade and local color and anatomy and the chemistry of pigments; they have studied ceaselessly from models and drapery, they have striven to perfect themselves in all the technique of a peculiarly difficult and complicated art. Michael Angelo and Leonardo and the other giants of the Italian Renaissance thought no detail of anatomy or of physics beneath their notice; they studied the human frame as if they were going to be doctors, the laws of matter as if they were going to be mechanical engineers, and the principles of optics as if they were going to be manufacturers of telescopes and magnifying-glasses. Literature bears on its face to a less degree the marks of study; but even here every great poet is known to have spent hours and hours in polishing and repolishing his every line, while a single essay of Macaulay's or a single chapter of John Stuart Mill's often bears on each page the stamp of days or weeks of reading,

thinking, condensing, and arranging. George Eliot took years to elaborate the plot and characters of each of her novels; and a great living philosopher is known to employ a whole morning in marshalling and dictating the matter already prepared for a single paragraph.

That is how genius, real and recognized genius, always goes to work at its own vocation. We do not say that much does not depend upon natural gifts — that would indeed be grossly untrue; but the most important of these natural gifts, we maintain, is, after all, the gift of application. Indeed we are not sure that we might not with greater truth exactly reverse the ordinary estimate, and say that genius is really talent backed up by application. The man of talent too often relies upon his natural abilities; he is too ready to think that his mere cleverness will stand him in good stead of hard work, profound study, constant care, the ceaseless exercise of intelligent attention. The consequence is that he frequently turns out a brilliant failure. The true genius, on the other hand, is born with an unquenchable desire to do his best, and to perfect himself by all the means in his power for his own special and chosen function. Gibson, the great English sculptor, was a born genius in the artistic way, and he was apprenticed at first to a wood-carver and then to a stone-cutter. The lad of mere talent, in such

circumstances, would have considered himself a divinely gifted sculptor, and would have begun at once turning out marble statues by the light of nature as fast as he could make them. But Gibson knew better. He knew he was a genius, and he resolved to give himself a fair chance. In his spare hours he went to an anatomy-class in Liverpool, among the young surgeons, and thoroughly learnt the bones and muscles of the human frame. He studied drawing, modelling, and carving; he omitted no chance of seeing and comparing Greek and Italian sculpture; and at last, with what slender means he had been able to save from his scanty wages, he went to Rome itself to study under Canova, the greatest master then living. While there, he met a young man of talent, a rising sculptor, who had come to Rome, like himself, to look at the statues, but who disdained the aid of masters and instructors, as beneath his greatness. Gibson thought very poorly of this self-sufficient rising sculptor. The young man went home to England, made statues by the light of nature, and was utterly forgotten: Gibson stopped at Rome, spent years of his life under his distinguished master, wasted hours — as many people would have said — over the mere turns and folds of a piece of drapery, and rose in the end to be the greatest sculptor whom England

has ever yet produced, with the one doubtful exception of John Flaxman.

The late Mr. Darwin, the founder of the modern philosophical school of natural history, was perhaps the most striking example that ever lived of genius considered as an infinite capacity for taking trouble. With a marvellously wide and comprehensive brain, capable of organizing and arranging the vastest masses of solid facts, and of discovering and formulating the profoundest underlying scientific principles, Darwin could still devote his time with the utmost patience to collecting and observing the minutest details of habit or function in climbing plants, or insect-eating leaves, or common earthworms. No point was too small for his vigorous intelligence, if only by its aid some light could be thrown upon a doubtful process in the economy of nature; no pains were too great for his inexhaustible patience, if only some truth was to be discovered or some principle made clear. The same man who could survey the whole field of geological time with his calm and far-seeing eye, and who could point out the laws of development for the entire vegetable and animal world, could also bend his attention for hours together to the pettiest and most trivial details of how the root of a sprouting pea twisted in the sunlight, or how a peacock displayed his gorgeous tail, in the absence of any

other admiring spectator, before the unobservant eyes of the domestic pig. One of his servants once remarked to a lady of the family that "master" would be much livelier if he had something to do, "for I saw him only this morning standing for half an hour with his eyes straight before him, looking at a plant growing out in the conservatory." The great philosopher was really engaged all that time in watching the effect of a ray of sunlight in twisting a leaf out of its original direction. In itself, such an observation may seem simple and trivial enough; but it was from an immense number like it that Darwin finally built up those great and embracing theories which have done more to influence modern thought, for good or for evil — take it as we will — than any others ever broached since the sixteenth century.

This view of the relations between genius and talent has one great point to recommend it — in the ordinary language of Scotch theology, it is indeed a very comfortable doctrine. If genius be really nothing more than an exceptional capacity for taking pains, then each one of us can come much nearer to being a genius by our own deliberate exertions than we perhaps ever before suspected. Instead of these exceptional persons being divided from common humanity, as many good souls imagine, by an impassable barrier, there is really no possibility of drawing a line

between the dull people, the sensible people, the intelligent people, the clever people, the people of talent, and the regular geniuses. From top to bottom the scale of ability goes on gradually by infinitesimal gradations, and there is nothing, in the last resort, to mark the very greatest men and women from those just beneath them in the intellectual scale, except perhaps a rather greater amount of painstaking attention. Granting this — and all example shows it to be true — it is quite possible for every one of us to raise ourselves several grades higher in the scale by the simple process of taking more trouble with everything we do. Of course it is possible that we may, some of us, have already reached the standard of absolute perfection in this respect; we may do with our might whatever our hand findeth to do, according to the beautiful Scriptural adjuration; but such models of attention must indeed be few and far between, and there can be little doubt that in most cases a trifle more of application, no matter to what end directed, — business, instruction, handicraft, the common affairs of every-day life, — would sooner or later bring forth good fruit, and raise us by so much in the scale of being. We are all very largely what we are born to be; but we are also very largely what we choose to make ourselves. People who think too much of the first clause in this natural antithesis

are apt to stick just where nature and circumstances originally placed them; people who duly recognize the truth of the second clause are likely to rise to the highest positions for which their natural endowments in any way fit them.

